Freeport-McMoRan Chino Mines Company

Smelter/Tailing Soils Investigation Unit Feasibility Study

Smelter Tailing Soils Investigation Unit
Chino Mine Investigation Area, Grant County, New Mexico

February 2025

Smelter/Tailing Soils Investigation Unit Feasibility Study

Smelter Tailing Soils Investigation Unit
Chino Mine Investigation Area, Grant County, New Mexico

February 2025

Prepared By:
Arcadis U.S., Inc.
630 Plaza Drive, Suite 200
Highlands Ranch
Colorado 80129
Phone: 720 344 3500
Fax: 720 344 3535

Prepared For:
Freeport-McMoRan Chino Mines Company

Our Ref:
30084756

Oscar Sorensen
Project Manager

Anne Thatcher
Principal Scientist

Lisa Gonzales, P.E.
Civil Engineer

Contents

Tables

Figures

Appendices

Acronyms and Abbreviations

AOC	Administrative Order on Consent
ARAR	Applicable or Relevant and Appropriate Requirement
bgs	Below Ground Surface
BMP	Best Management Practices
CCP	Closure/Closeout Plan
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CGCS	Comprehensive Groundwater Characterization Study
Chino	Freeport-McMoRan Chino Mines Company
COC	Constituent of Concern
COPC	Constituent of Potential Concern
csm	Conceptual Site Model
DEL	De minimis effects level
DOC	dissolved organic carbon
EC50	effects concentration at 50%
EPC	exposure point concentration
ERA	Ecological Risk Assessment
FS	Feasibility Study
FMRS	Freeport-McMoRan Reclamation Services
HHRA	Human Health Risk Assessment
HQ	hazard quotient
HSIU	Hurley Soils Investigation Unit
IA	Investigation Area
IRA	Interim Remedial Action
mg/kg	milligrams per kilogram
mm	millimeters
NCP	National Contingency Plan
NMAC	New Mexico Administrative Code
NMDOT	New Mexico Department of Transportation

NMED	New Mexico Environmental Department
NMWQCC	New Mexico Water Quality Control Commission
NRCS	National Resource Conservation Survey
OAT	Observed Apparent Trend
O&M	Operation and Maintenance
pCu	Cupric ion activity (pCu2+)
PEL	Probable Effects Level
pH	Hydrogen ion (standard units)
PRG	Preliminary Remediation Goals
RAC	Remedial Action Criteria
RAO	Remedial Action Objective
RI	Remedial Investigation
ROD	Record of Decision
ROW	Right-of-Way
SGFB	Small ground feeding bird
Site	Smelter/Tailing Soils Investigation Unit at the Chino Mine Investigation Area, Grant County, New Mexico
SSC	Site-Specific Criteria
STSIU	Smelter/Tailing Soils Investigation Unit
SWQB	Surface Water Quality Bureau
TBC	To Be Considered
TP	Tailing pond
UAA	Use Attainability Analysis
UCL	Upper Confidence Limit
USEPA	United States Environmental Protection Agency
WBT	wind-blown tailings
WER	Water Effect Ratio
WQS	Water Quality Standard
XRF	x-ray fluorescence

1. Introduction

The Feasibility Study (FS) was prepared for Freeport-McMoRan Chino Mines Company (Chino) to develop and evaluate potential remedial alternatives for the Smelter Tailing Soils Investigation Unit (STSIU) at the Chino Mine Investigation Area, Grant County, New Mexico (site). This FS has been developed in accordance with the requirements in the Administrative Order on Consent (AOC) following the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) guidance. The AOC, effective December 24, 1994, distinguishes between historical mineral processing activities and current operations at Chino.

1.1 Background

The STSIU is one of the Investigation Units identified within the Investigation Area (IA) of the AOC. The IA includes all areas in which environmental media may have been affected by historical operations at mining and processing facilities. The STSIU is located approximately 12 miles southeast of Silver City, and includes historical smelting facilities, mineral processing facilities, tailing ponds, and surrounding areas (Figure 1-1). The STSIU is located to the east of the town of Hurley, New Mexico which contained the Hurley Smelter, and has previously been defined as all areas containing and proximal to Chino's former copper smelter and ancillary facilities, including the tailings disposal facility (SRK 2008a).

In accordance with the AOC Scope of Work, a Remedial Investigation (RI) for the STSIU was conducted to generate the data necessary to evaluate the potential effects to human health and the environment from historically affected media in the STSIU. Data have been collected in the STSIU starting in 1995 and continuing to present day to determine potential impacts to soil, sediment, and surface water from historical mineral processing activities. The human health risk assessment (HHRA) and ecological risk assessment (ERA) have shown that areas of the STSIU have elevated metals concentrations and depressed pH in soil and surface water, as described in Sections 3.1.1 and 4.1.1. The FS Proposal for the STSIU presented activities necessary to evaluate remedial alternatives that comply with New Mexico Environment Department (NMED) Pre-FS remedial action criteria (RAC) (Arcadis 2011a).

NMED issued Pre-FS RAC for the STSIU (NMED 2010a, 2011a) including:

Soil

- 27 milligrams per kilogram (mg/kg) arsenic (0-1")
- 100,000 mg/kg iron in soil (0-1")
- 5,000 mg/kg copper (0-1")
- 1,600 mg/kg copper (0-6")
- Cupric ion activity (pCu^{2+}) (hereafter referred to as "pCu") $\geq$ 5 where copper > 327 mg/kg. Note: Chino interprets this to actually mean NMED selected areas for remedial decisions in the STSIU where cupric ion activity (pCu^{2+}) < 5 where copper is > 327 mg/kg.

Surface Water

- Water quality criteria contained in New Mexico Administrative Code (NMAC) §20.6.4.

These Pre-FS RAC values were developed based on the evaluations conducted in the RI, HHRA, and ERA. The FS and Record of Decision (ROD) will be completed consistent with the National Contingency Plan (NCP). Pre-FS RAC are consistent with the use of preliminary remediation goals (PRG) by United States Environmental Protection Agency (USEPA) in the NCP; therefore, new information can be used to refine the Pre-FS RAC and selection of alternatives (§300.430(e)(2)(i) NCP). Final remediation goals will be determined in the ROD. Further details about the Pre-FS RAC are presented in Section 2.4.

1.2 Objectives

The primary objectives of this FS, as initially presented in the FS Proposal (Arcadis 2011a), are to identify potential remedial areas and remedial technologies to address contaminated soil, sediment, and surface water in the STSIU. To achieve this, remedial action objectives (RAOs) were developed to define the basis for remediation, including numerical Pre-FS RAC as discussed in the previous section. Remedial technologies described in this document were assessed using the CERCLA FS criteria (Section 4.3, USEPA 1988) to determine their potential to meet the project RAOs.

As part of the FS Proposal, a comprehensive literature review was completed, and potential remedial technologies were identified for application at the STSIU (Arcadis 2011a). Remedial technology alternatives evaluated in this report are unchanged from the FS Proposal and analysed individually and in comparison with each other using the following criteria: overall protection of human and ecological receptors, compliance with applicable or relevant and appropriate requirements (ARARs); long-term effectiveness and permanence; reduction in toxicity, short-term effectiveness, implementability; and cost. The FS process followed to conduct the evaluation of alternatives presented in the FS includes the following steps:

- Summarize RAOs and Pre-FS RAC that address the key risk drivers and potential routes of exposure;
- Identify areas where potential remedial action(s) may be necessary to address RAOs and Pre-FS RAC;
- Identify and screen potential remedial technologies;
- Develop remedial alternatives; and
- Evaluate the remedial alternatives considering the FS criteria.

The above steps will be used to guide the selection of the preferred remedial alternatives.

1.3 Summary of Related Current Activities

Between the start of the AOC process in April 1995 and July 2022, there have been a number of site characterization or remediation activities in or near the STSIU at Chino. These include the following:

- AOC Interim Removal Action Work Plan and Completion Report for Interim Remedial Action, Hurley Soils Investigation Unit, (Golder 2006, 2008)
- Phase 1 Remedial Investigation Proposal, Hanover and Whitewater Creeks Investigation Unit (Golder 1999a)
- Comprehensive Groundwater Characterization Study (CGCS) (Golder 1999b)
- Phase II Revised Remedial Investigation Report, Hurley Soils Investigation Unit (Golder 2000a)

- Phase 1 Revised Remedial Investigation Report, Hanover/Whitewater Creek Investigation Unit (Golder 2000b)
- Remedial Investigation Proposal, Smelter Tailings Soils Investigation Unit (SRK 2004)
- Sitewide Baseline Ecological Risk Assessment (NewFields 2006a)
- Slag Pile Characterization (Golder 2007)
- Remedial Investigation, Smelter Tailings Soils Investigation Unit (SRK 2008a,b)
- Smelter Tailings Soils Investigation Unit Ecological Risk Assessment (NewFields 2008)
- Smelter Tailings Soils Investigation Unit Human Health Risk Assessment (Gradient 2008)
- Smelter/Tailing Soils Investigation Unit Interim Removal Action (IRA) Completion Report ("Golf Course IRA" Arcadis 2009)
- STSIU Terrestrial Invertebrate Bioaccumulation and Bioavailability Study (Arcadis 2010a)
- Groundwater Quality Pre-FS RAC for Drainage Sediments Study (Arcadis 2011b)
- Chino Mines Tailing Pond 1 & 2 Construction Quality Assurance Report (Golder 2013a)
- Tailing Pond B/C Construction Quality Assurance Report (Golder 2013b)
- Supplemental Completion Report, Interim Removal Action, Smelter/Tailing Soils Investigation Unit ("Railroad IRA", Golder 2013c).
- Development of Site-Specific Copper Criteria Interim Report (Arcadis 2013a,b).
- Construction Quality Assurance Report, Lake One Reclamation (EMC2 2014)
- Supplemental Completion Report, Razorback Ridge Area, Interim Remedial Action, Smelter/Tailing Soils Investigation Unit (Golder 2015)
- Year 5 Monitoring Report for STSIU Amendment Study Plots (Arcadis 2017) (Appendix A)
- Year 5 Report on pH Monitoring to Evaluate the Effect of the White Rain on STSIU (Arcadis 2023) (Appendix B)
- B-Ranch Interim Remedial Action Completion Report Smelter/Tailing Soils Investigation Unit (Arcadis 2021)
- Assessment Report for Apache Tejo Wash (Golder 2024)
- Phytotoxicity and Vegetation Community Study (Arcadis 2018, Appendix C)
- Reference Area Technical Memorandum (Arcadis 2024, Attachment A in Appendix D)

A brief overview of the above reports for 2011 and prior years was included in the approved FS Proposal (Arcadis 2011a). Several of the above reports have been updated or are new since the submittal of the FS Proposal in 2011. These reports are summarized below including reports that followed the FS Proposal.

Interim Removal Action for STSIU - Golf Course and Railroad

The *Interim Removal Action (IRA) for the STSIU* (Arcadis 2006, 2009) and *Supplemental IRA for the STSIU* (Golder 2013c) addressed elevated copper in surface soil to the north and west of Hurley, New Mexico. A former golf course existed to the north of the Town of Hurley. The North and South Golf Course designation refers to this area; the division between the north and south is the access road to the Chino facility entrance in Hurley. Areas to the east and west of Highway 180 on the west side of the Golf Course were included (Arcadis 2009) as well as acres alongside the railroad (Golder 2013c)[1].

The objective of the IRA was to remove areas where soil copper concentrations were greater than 5,000 mg/kg (lateral delineation). Chino applied the NMED-approved residential RAC for the Hurley Soils Investigation Unit (HSIU) as a conservative measure in 2008. STSIU Pre-FS RAC was defined by NMED in 2009. Within the area exceeding 5,000 mg/kg copper, the excavation was completed vertically until the soil did not exceed 2,700 mg/kg copper or bedrock was encountered and, as a result, the spatially weighted 95 percent upper confidence limit (95UCL) copper concentration in the 0-6 inch depth interval is estimated to be 1,314 mg/kg. Therefore, while this remedy was implemented prior to NMED issuing final pre-FS RAC, the soil removal meets the bird pre-FS RAC of 1,600 mg/kg.

Freeport-McMoRan Reclamation Services (FMRS) performed the IRA excavation activities in partnership with Arcadis, who conducted the field engineering services, which took place from January 2008 to August 2008. A supplemental IRA excavation of the remaining 32 acres between the town of Hurley and the golf course sites was conducted from August 2012 to December 2012 by TIPE Construction with oversight by Golder. Excavation depths during the IRA activities averaged three inches below ground surface (bgs) for the total removal area. Based on confirmation sampling and refinement of the removal areas, approximately 170 acres of the proposed 190 acres in 2008 and approximately 32 acres in 2012 were ultimately remediated for a total of 202 acres. Final excavation volumes were determined by contractor load counts. The total volume removed during these IRAs are estimated at 68,112 cubic yards (Arcadis 2009) and 22,125 cubic yards (Golder 2013c).

Following the completion of the IRAs in 2008 and 2012, five years of monitoring was completed for both sites to document the successful revegetation of the IRA footprint (Arcadis 2014c, Golder 2018). The results of the five-year monitoring effort demonstrated the successful development of an early-seral stage mixed grama herbaceous alliance across the Golf Course sites. The canopy cover levels exceed the reference area guidance for canopy cover, and the data indicated that native species colonized the site with minimal cover from non-native species. Further, the vegetation limited erosion and controlled dust.

Interim Removal Action for STSIU – Razorback Ridge and B-Ranch

An IRA was completed east of Lake One in areas adjacent to the Whitewater Creek Diversion Channel and James Canyon in 2013 and 2014 in an area referred to as Razorback Ridge (Golder 2015). The objective of this IRA was to remove soils in areas with copper concentrations higher than 5,000 mg/kg, delineated laterally, as per the STSIU pre-FS RAC. Within the areas with higher than or equal to 5,000 mg/kg, soils were removed vertically to a depth of 1 to 2 feet as this surface soil volume was utilized as borrow fill material for reclamation. The final excavation area for the Razorback Ridge Area (which includes the East Removal Borrow Area) addressed in 2013 and 2014 was 94 acres. An additional 29 acres within the IRA Area were remediated through operational construction excavation and borrow activities prior to 2002. Soils were excavated to a depth of approximately 12 inches down to 40 feet during excavation for borrow material, exceeding the target remediation depths. See next

[1]The Highway 180 right-of-way (ROW) extends 50 feet on either side of the roadway and is considered by the New Mexico Department of Transportation (NMDOT) to be under its management. Any impacted soils within the Highway ROW will be addressed by NMDOT as part of their planned expansion of Highway 180 from a 2-lane roadway to a 4-lane roadway for the entire corridor between Bayard and Deming (NMDOT 2021). Chino expects to coordinate with NMDOT prior to planned construction and anticipates proposing an option for disposal of copper contaminated soils in compliance with existing regulatory requirements.

bullet section below. In all areas of removal, the Pre-FS RAC for the STSIU of 5,000 mg/kg for copper was achieved (Golder 2015). Approximately 113,000 cubic yards of soil (73 acres) from Razorback Ridge and 34,000 cubic yards of soil (21 acres) from the East Removal Borrow Area were removed between 2013 and 2014 and used for borrow material, specific to the IRA requirements.

An additional IRA was completed in 2019 for the B-Ranch area located adjacent to the reclaimed Slag Pile, the Golf Course IRA sites, as well as the Town of Hurley. Approximately 16,000 cubic yards of soil (22 acres) from B-Ranch site were removed. In all areas of removal, the Pre-FS RAC for the STSIU of 5,000 mg/kg for copper was achieved (Arcadis 2021).

Lake One and Tailing Pond Reclamation – Borrow Fill

As part of the Closure/Closeout Plan (CCP) reclamation activities, Chino removed borrow fill, including wind-blown tailings (WBTs), from the east and west sides of the historic tailings dams in 2013 (Golder 2013a, 2013b, and 2013d) and 2014 (EMC2 2014). The extent of the borrow removal of more than 520 acres of land included the Razorback Ridge Borrow Area (87 acres), the South James Canyon Borrow Area (90 acres), Borrow Area A (71 acres), Borrow Area B (41 acres), Borrow Area C (50 acres), and Borrow D (153 acres). There was an additional 574 acres of WBT utilized as grading fill material where only the surface one foot depth was borrowed for Tailings Pond 1, 4, and 6. Borrow Areas A, B, and C, as well as Razorback Ridge, were used for fill and cover material for Tailings Pond 1, 2, B, C, 4, 6E and 6W and for Lake One. The top 2 feet of surface areas on the Razorback Ridge Areas and South James Canyon Borrow Area were removed and used as grading fill (i.e., below the base of the cover) within Lake One. Once placed, the WBT fill material also received a minimum 3-foot thickness of cover material along with the rest of the Lake One reclamation area. These borrow areas are addressed under the CCP.

Site Specific Copper Criteria Study

Arcadis conducted a copper water effect ratio (WER) study for the STSIU surface waters in 2011. As described in the WER work plan (Arcadis 2011c), the purpose of the WER study was to evaluate the site-specific toxicity of copper in STSIU surface waters and to determine whether the hardness-specific copper criteria accurately reflect site-specific copper bioavailability and toxicity. A total of 24 STSIU water samples were collected in the WER study, including 18 toxicity test samples and an additional 6 analytical chemistry samples.

Results from the WER study were described in the *Development of Site-Specific Copper Criteria Interim Report* submitted to NMED in March 2013 (Arcadis 2013a). The primary objectives of this Criteria Adjustment Interim report were to report all data collected as well as any deviations from the work plan, evaluate all collected data with quality control criteria described in the WER guidance (USEPA 1994, 2001), and determine if the collected data are sufficient to develop copper site-specific criteria (SSC) that can be applied to STSIU surface waters. Broadly, this study demonstrated that hardness-adjusted copper criteria are overly protective for surface waters of STSIU drainages, and the methods listed in Section 20.6.4.10, part D of NMAC can be successfully applied to surface water in STSIU drainages. The Interim WER Report also established that the toxicity and chemistry data collected were acceptable for deriving WERs when these data are compared to USEPA (1994 and 2001) WER acceptability criteria. Preliminary WERs were calculated according to USEPA guidance (USEPA 1994, 2001) and presented in that report. A site-specific copper WER model was subsequently developed to derive adjusted copper criteria in STSIU surface waters in the *Revised Site-Specific Copper Toxicity Model Report* submitted to NMED in October 2013 (Arcadis 2013b). The site-specific criteria for STSIU surface waters were adopted by NMED and are contained in NMAC §20.6.4.808 - 809.

STSIU Amendment Study Plots

Chino implemented the STSIU Amendment Study in 2008 based upon an NMED-approved work plan to explore the possible remedial options to determine if lime and organic matter amendments with or without tilling could be an effective and feasible remedial action to address the elevated copper concentrations and depressed pH in surface soils within the STSIU (Arcadis 2008a). The study tested the longevity of pH stabilization, copper sequestration ability, vegetative re-colonization, and constructability (Arcadis 2017, see Appendix A).

In June of 2008, Chino applied lime and organic matter to three test plots, and one test plot was used as a control with no amendments or tilling. A control plot with no treatment was also established adjacent to each of these four plots. During the application of lime and organic matter, two of the test plots on relatively level ground were also tilled. Chino conducted monitoring of the copper, pH, and vegetation cover, diversity, and richness before and after amendment application. The results from the monitoring events were presented in the *Year 5 Monitoring Report for Smelter/Tailings Soils Investigation Unit Amendment Study Plots* (Arcadis 2017). In summary, an unexpected white rain (discussed in next section) increased pH and pCu significantly and reduced copper uptake into plants of all the plots, which was sustained over the 5-year monitoring period.As a result, the treatments added to the soil in the plots provided minimal if any additional benefit in further reducing copper impacts to the plant community because the white rain already significantly improved the soil chemistry. The white rain also increased plant species richness on the untreated plots but had a minimal, if any, positive effect on total plant cover (decreased cover in some plots). The vegetation community of the steeper plot was degraded by the two amendments, with a loss of rangeland grasses and desirable shrubs. The tilling and mixing of lime amendments into the soil tended to increase pH but degraded the plant community on the fair rangeland plot and improved the plant community on the poor rangeland plot; however, the recovery of degraded conditions could take decades. Liming and tilling are only recommended in relatively flat, poor rangeland rocky areas where phytotoxicity from copper can be demonstrated. Tilling alone has been shown to be effective and should be tried first at an 8-inch depth and deeper to evaluate the proper depth but only on slopes < 13% and where the rangeland condition is poor. Organic matter application in the form of manure was not recommended.

STSIU pH Monitoring

A significant upward shift in pH was observed in the STSIU following a "white rain" precipitation event on January 7, 2008 (Arcadis 2008b). To quantify the permanence of this trend, Chino submitted, and NMED approved, the Soil pH Monitoring Work Plan in 2010 (Arcadis 2010b). The Work Plan outlined eighteen locations (increased to 22 in 2011) to monitor soil pH over 5 years[2], with annual reports provided to NMED after each sampling event and a final, Year 5 report summarizing the results of the pH monitoring effort (Arcadis 2023, see Appendix B).

The results of the 5-year study showed that the 2008 white rain benefitted the STSIU soils by increasing the pH and pCu of the acidic soils, making copper less bioavailable likely due to the increase in copper adsorption by secondary soil minerals, such as iron hydroxide, at higher pH values (Arcadis 2023). The increase in pCu led to a decrease in the uptake of copper into living organisms. In locations showing an improvement (increase) in soil pH, the tissue copper concentrations decreased after the white rain by more than 60% for the plants and by up to 40% for the insects. The ultimate result appears to be reduced toxicity to wildlife due to reduction in copper in their diet. Thus, the white rain improved wildlife and rangeland habitat by decreasing copper in food sources (and improved vegetation richness, but not cover as discussed in Appendix A). Based on Mining and Minerals Division guidelines and mineralogical analysis, the potential of STSIU soils to generate acid is consistently low in most areas. Based

[2] Soil excavations from reclamation borrow activities over the monitoring period removed five of the sample locations, so five additional locations were added in 2012. Overall, 17 locations were monitored all five years.

on results reported in the *Year 5 Report on pH Monitoring to Evaluate the Effect of the White Rain on the Smelter/Tailings Soils Investigation Unit* (Arcadis 2023), persistence in the future cannot be predicted with certainty, and additional five-year monitoring is recommended as part of the STSIU FS to confirm the prediction that the pH increase should be sustained. Appendix B includes the revised report plus a brief response to NMED comments (see Appendix I of the pH monitoring report for response to comments).

Phytotoxicity and Vegetation Community Study

The site-wide and STSIU-specific ERAs stated that elevated concentrations of copper and other metals, combined with depressed soil pH, have led to a risk of phytotoxicity for some areas of the Site based on site-specific greenhouse phytotoxicity studies and plant community surveys in 1999 (NewFields 2006a, NewFields 2008, Schafer and Associates 1999a,b). For plants, these ERAs linked the toxic action of total copper in the shallow surface layer of the soil to cupric ion activity, quantified as pCu. Site conditions changed since the original studies, however, requiring additional studies; specifically, the two historical smelter stacks were shut down in 2002 and demolished in 2007. Reclamation of Lake One and older tailing dams was also completed. Additionally, a significant upward shift in soil pH was observed at STSIU following the "white rain" precipitation event on January 7, 2008. The change in soil pH due to the white rain event has lowered cupric ion activity of the soil (Arcadis 2023) and, more importantly, possibly changed the complex soil geochemistry (e.g., cation exchange capacity) in a manner that could shift the relationship between pCu and plant and community endpoints. In addition, the 1999 phytotoxicity and community studies did not explicitly account for site-specific seeds of native species, representative background, or potentially confounding physical and chemical factors across various soil categories.

New studies were proposed by Chino in 2013 to address these changes, approved by NMED in 2014. Data collection was completed in 2015, results submitted in April 2017 and re-submitted in August 2017 for NMED review. The report in Appendix C was updated in 2018 and addresses the last set of NMED comments provided in January 2018; the responses to NMED comments are attached at the end of the report. The native site species did not always perform better than non-native species in the greenhouse study, and their addition produced a minimal change in the results relative to 1999 results. However, dose-response models for each category of soil (bedrock, steep slope, flat granular, flat rocky) produced a different de minimus effects level (DEL) or probable effects level (PEL) for toxicity of copper than the 1999 data based on the plant community data. A DEL was defined as the "lowest soil pCu level… below which statistically demonstrable effects are unlikely". The PEL was defined as "pCu levels at which statistically demonstrable effects are probable (e.g., pCu at which approximately 50% of the test population is affected)." The variable DEL and PEL values, depending on soil conditions, create uncertainty around the application of a pre-FS RAC for vegetation across all soil types, and on whether more harm than good will result if simple cleanup criteria are used across the entire Investigation Unit. This study's information was useful for the FS because it defines areas on the site by the four soil categories of bedrock, steep slope > 13%, flat granular, and flat rocky soils that strongly influence plant responses to pCu. The community study was based on site soils that were not homogenized in the laboratory (maintaining pCu stratification) and are the most representative of field conditions.

Draft Technical Memorandum on pCu Reference Area Visit and Analysis

Based on NMED comments regarding the phytotoxicity report and an August 2018 meeting between Chino and NMED, Chino proposed sampling additional locations for "reference" or "background" to increase confidence in conclusions. Reference areas were identified in the field with NMED, and Chino sampled the community metric endpoints of cover, richness, and rangeland condition (via Observed Apparent Trend [OAT] score) as well as soil chemistry (pH, total copper, and sulfate) across all four soil categories identified in the phytotoxicity study (Arcadis

2018): flat granular, flat rocky, bedrock, and steeper slopes (>13%). Eight reference areas were sampled for soil and surveyed for three plant endpoints (OAT score, richness, cover) in October 2018, bringing the total reference area dataset to be used for comparing plant communities on site to reference areas off site to ten, given that two reference sites (wildlife reference north and STS-PT-2013-26) had been sampled previously. Three additional STSIU onsite locations were sampled or surveyed. Two of these were sampled for soil chemistry and/or plant community data to evaluate pCu at highly overgrazed areas on the site, and one (wildlife reference south plot) was sampled and surveyed along with the wildlife reference north location to calibrate changes[3] in plant cover due to the climatic differences over 3 different years of sampling (2011, 2014, 2018); this repeat survey ensured that on-site and off-site area data are comparable.

Like the two previously sampled reference locations, all new reference locations had sulfate concentrations and pH in the soil within the expected range for the geology and soils of the location, indicating that they do not have any smelter or windblown tailing impacts. These results support that the new reference locations adequately represent background conditions without mining impacts. The new reference area data are **not** incorporated in the phytotoxicity study report, however, because it has been through several review cycles with NMED. Instead, data from the new reference locations were evaluated in a Technical Memorandum (Tech Memo) and in this FS as to how they affect DELs and PELs for pCu impacts on the vegetation community. The Tech Memo (Arcadis 2024) is provided as Attachment A to Appendix D and the final analysis and methods used to identify DELs and PELs in that Tech Memo using the new reference data is discussed in Appendix D. DELs and PELs presented in the community section of the phytotoxicity report were recalculated with the new data. The recalculation is important because the phytotoxicity study did not have any reference areas representative of flat rocky, bedrock, or slopes > 13%. Previous community PEL and DEL were based on the flat granular reference area, underestimating the values for the other 3 soil categories. The average of wildlife habitat quality-based endpoints (plant richness and cover) was calculated separate from the rangeland condition endpoint (OAT score). The highest of the two PELs was selected as the final PEL protective of wildlife habitat and rangeland condition for each soil category. The final PEL ranged from 4.11 to 4.98, depending on the soil category. Flat rocky soils had the highest PEL.

Assessment Report for Apache Tejo Wash

Chino documented completion of an NMED request for a “ground survey” of the entire Apache Tejo drainage system in 2021. The “ground survey” includes historical information, as well as reconnaissance results and property ownership information. The “ground survey” covers the entire wash from the Chino tailing impoundments to Whitewater Creek, including two tributaries to Apache Tejo Wash. Chino also characterized tailing and other materials along the wash and interpreted the data with respect to the potential for exposure and the potential for re-release to other media, including groundwater. The Assessment Report concluded that the potential for constituents to infiltrate to groundwater is low; the tailing in the channel and the Big Berm generally showed little to no potential to generate acid or leach metals (Golder 2024). The depth to groundwater is 100 feet along the wash, and the vadose zone is comprised of alluvium and Gila Conglomerate with neutralizing potential. Also, there is limited potential to re-release constituents to surface water because recent, cleaner sediment has covered much of the historical tailing along the wash with a couple limited exceptions. The data were screened

[3]Wildlife Reference North and South locations were sampled each year of community sampling to calibrate cover. The wildlife reference south location was originally thought to be a reference area but had lower pCu once sampled and became a “de minimis” location along with three bedrock reference locations that had lower pCu than 5 (see phytotoxicity report).

against STSIU Pre-FS RAC for birds and vegetation and no further action was recommended. Apache Tejo Wash will be further considered under Discharge Plan DP-1340 Sitewide Abatement.

1.4 AOC Requirements

The AOC between Chino and NMED became effective on December 24, 1994 and requires Chino to conduct the following work:

- Assess present STSIU condition in the investigation area associated with risks to public health and welfare of the environment;
- To the extent necessary to select a remedy, or remedies, evaluate alternative remedial technologies appropriate for the Investigation Unit in the investigation area; and
- Implement the selected remedy or remedies.

FS activities that were identified in the AOC Scope of Work and described in the FS Proposal (Arcadis 2011a) include, but are not limited to:

- Description of current situation;
- Treatability studies and identification and screening of potential applicable technologies;
- Development of remedial alternatives;
- Initial screening of remedial alternatives;
- Detailed evaluation of remedial alternatives;
- Description and justification of preferred alternative; and
- Production of the FS report.

This FS addresses the above bullets.

1.5 Organization of FS

This FS was prepared to determine and fulfil the needed data requirements of the AOC identified FS activities. The FS is organized as follows:

- Section 1.0: Introduction
- Section 2.0: Regulatory Components of the FS
- Section 3.0: Description of Current Situation: Soil
- Section 4.0: Description of Current Situation: Surface Water
- Section 5.0: Identification and Screening of Potential Applicable Technologies
- Section 6.0: Assembly and Development of Remediation Alternatives
- Section 7.0: Analysis of Alternatives
- Section 8.0: Final Acres for Remedial Actions or Monitoring

- Section 9.0: References

2. Regulatory Components of the FS

There are a number of regulatory components associated with an FS. Section 2.1 presents the specific FS tasks that are stated and required in the AOC associated with STSIU. Section 2.2 presents the ARARs associated with the STSIU. Sections 2.3 and 2.4 provide details on the RAOs and the Pre-FS RAC that have been developed for the STSIU. Finally, Section 2.5 describes the AOC STSIU study boundaries.

2.1 AOC FS Tasks

AOC FS Tasks were presented in the FS Proposal (Arcadis 2011a) and are updated herein based on additional work completed.:

Description of Current Situation

Updates to the current situation are detailed in Sections 3 and 4.

Treatability Studies and Identification and Screening of Potentially Applicable Technologies

Remedial technologies were identified in the approved STSIU FS Proposal (Arcadis 2011a). As described in the FS Proposal, several of the remedial technologies would have relied on the results of pilot treatability studies, including ferrihydrite as a soil amendment, chelating agents as a soil amendment, *ex-situ* and *in-situ* soil washing, phytoextraction, and electrokinetic remediation. However, none of those technologies were retained for inclusion in the remedial alternatives assembled in this FS Report (see Section 6) and, therefore, no treatability studies were implemented other than the completed amendment study was initiated before the FS Proposal was submitted and approved. The technologies that were identified to carry forward are incorporated into remedial alternatives herein.

Development of Remedial Alternatives

Remedial alternatives were developed in the FS Proposal (Arcadis 2011a) and no additional alternatives were identified or developed through the implementation of that proposal.

Initial Screening of Remedial Alternatives

The initial screening of remedial alternatives was completed in the FS Proposal (Arcadis 2011a). For this FS, the alternatives of using chelating agents (for ex-situ and in-situ soil washing and phytoextraction), an impermeable soil cover, phytoremediation, and electrokinetic remediation are screened out, as described further below in Section 5.

Evaluation of Remedial Alternatives

Remedial alternatives were evaluated in the FS Proposal (Arcadis 2011a) and no changes to that evaluation have been identified through the implementation of that Proposal. The remedial alternatives identified in the FS Proposal that were carried forward into the FS include the following:

Soil

- No Action
- Monitoring
- Excavation and Reuse
- Excavation and Disposal

- Limestone and Organic Matter Soil Amendment
- Tilling
- Ferrihydrite Soil Amendment
- Soil Cover
- Phytostabilization

Surface Water

- No Action
- Monitoring
- Excavation (In-Drainage, Upland, or Stock Ponds)
- In-Stream Removal of Suspended Sediments
- Limestone Treatment
- Sediment and Erosion Control

Description and Justification of Preferred Alternative

In the FS Report, Chino shall describe and justify its preferred alternative based on the criteria listed above.

2.2 Applicable or Relevant and Appropriate Requirements

ARARs are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address the situation at a CERCLA site. The requirement is applicable if the jurisdictional prerequisites of the standard show a direct correspondence when objectively compared to conditions at the site. An applicable federal requirement is an ARAR. An applicable state requirement is an ARAR only if it is more stringent than the federal ARAR.

If the requirement is not legally applicable, then the requirement is evaluated to determine whether it is relevant and appropriate. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not applicable, address problems or situations similar to the circumstances of the proposed response action (relevant) and are well suited to the conditions (appropriate) of the site. A requirement must be determined to be both relevant and appropriate in order to be considered (TBC) an ARAR.

The criteria for determining relevance and appropriateness are listed in the Code of Federal Regulations (40 CFR), Section 300.400(g)(2), and include general comparisons between the following:

- The purpose of the requirement and the purpose of the action;
- The medium regulated or affected by the requirement and the medium contaminated or affected at the site;
- The substances regulated by the requirement and the response action contemplated at the site;
- Any variances, waivers, or exemptions of the requirement and their availability for the circumstances at the site;

- The type of place regulated and the type of place affected by the release; and
- Any consideration of use or potential use of affected resources in the requirement and the use or potential use of the affected resources at the site.

According to the USEPA CERCLA guidance, a requirement may be “applicable” or “relevant and appropriate” but not both (USEPA 1988). Identification of ARARs must be done on a site-specific basis and involves a two-part analysis: first, a determination of whether a given requirement is applicable; and then, if it is not applicable, a determination of whether it is, nevertheless, both relevant and appropriate. When the analysis determines that a requirement is not applicable but is both relevant and appropriate, the requirement must be compiled with the same degree as if it were applicable.

ARARs are generally divided into three categories: chemical specific; location specific; and action specific in accordance with USEPA guidance (USEPA 1988):

- Chemical Specific: Chemical specific ARARs are generally health or risk based numerical values or methods applied to site-specific conditions that results in the establishment of a cleanup level. Many potential ARARs associated with particular response alternative (such as closure) can be characterized as action-specific but include numerical values or methods to establish them so they fit in two categories, chemical-specific and action-specific.
- Location Specific: Location specific ARARs are included for environmentally sensitive areas including riparian and other hydrologic resources, and biological and other natural resources are the resource categories relating to location-specific requirements potentially affected by the STSIU remedial actions.
- Action Specific: Action specific ARARs are included for the potential remedial actions that will be used in the STSIU.

This classification was developed to aid in the identification of ARARs. Some ARARs do not fall precisely into one group or another. ARARs are identified on a site-specific basis for remedial actions where CERCLA authority is the basis for cleanup.

For the determination of relevance and appropriateness, the pertinent criteria were examined to determine whether the requirements address problems or situations sufficiently similar to the circumstances of the release or response action contemplated, and whether the requirement is well suited to the site. A negative determination of relevance and appropriateness indicates that the requirement does not meet the pertinent criteria.

To qualify as a state ARAR under CERCLA, a state requirement must be:

- A state law or regulation;
- An environmental or facility law or regulation;
- Promulgated;
- Substantive;
- More stringent than federal requirements;
- Identified in a timely manner; and
- Consistently applied.

To constitute an ARAR, a requirement must be substantive. Therefore, in some cases only the substantive provisions of requirements identified as ARARs in this analysis are considered to be ARARs. Permits are considered to be procedural or administrative requirements though may contain substantive requirements that are ARARs which must be attained and/or qualify as “to be considered” (TBC) materials that may be used in determining the necessary level of cleanup for protection of human health or the environment.

Provisions of generally relevant federal and state statutes and regulations that were determined to be procedural or not environmental in nature, including permit requirements, are not considered ARARs. CERCLA Section 121(e)(1), (42 USC Section 9621(e)(1)), states that “No Federal, State, or local permit shall be required for the portion of any removal or remedial action conducted entirely on-site, where such remedial action is selected and carried out in compliance with this section.” Consistent with 40 CFR, the term “on-site” is defined for purposes of this ARARs discussion as “the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementations of the response action.

In addition to ARARs, non-promulgated advisories, proposed standards, criteria, guidance, or policy documents developed by the federal or state government, or other information referred to as TBC materials may also be used in conjunction with ARARs to achieve an acceptable level of risk at a site. Although not legally binding, TBCs may be used when determining protective cleanup levels or response actions where no ARARs exist, or where ARARs alone would not be sufficiently protective of human health and the environment. Because TBCs are not ARARs, their early identification is not mandatory.

The state permit conditions for the Chino Mine shall be considered TBC materials and considered in the FS for developing remedial alternatives.

Chino had the primary responsibility for identifying federal ARARs for the STSIU. Potential federal ARARs that have been identified for the remediation of STSIU were determined in the RI (SRK 2008a) and FS Proposal (Arcadis 2011a) and are presented in Tables 2-1, 2-2, and 2-3. Pursuant to the definition of the term “on-site” in 40 CFR Section 300.5, the area that is considered part of the remedial action is STSIU (see Section 2.5).

2.3 Remedial Action Objectives

This section identifies the environmental media for the STSIU where potentially unacceptable risks were determined to exist through the risk assessments completed during the RI, as well as the constituents determined to be responsible for the potential for unacceptable risk. This section also presents the specific RAOs developed for the STSIU for each media of interest.

RAOs are medium-specific goals designed to protect human health and the environment. RAOs serve to focus an FS and provide context for the overall scope of potential cleanup activities at a site. Each RAO specifies: the contaminant of concern; the relevant exposure routes and receptors; and an acceptable contaminant concentration or range of concentrations for each exposure pathway.

The STSIU RI referenced the completed STSIU HHRA and ERA to determine if any constituents present in the environmental media should be considered Constituents of Potential Concern (COPCs). The sitewide and STSIU-specific ERAs (NewFields 2006a, 2008) considered sensitive representative receptors from a number of receptor classes including mammals, birds, plants, and invertebrates. NewFields evaluated direct contact for plants and invertebrates and incidental soil ingestion and food-chain transfer for birds and mammals. The RI also referenced the comprehensive HHRA performed by Gradient (2008) to determine if any chemicals present in environmental media at the site are responsible for potentially unacceptable risk to human receptors in the context of plans for future site use. Accordingly, the human receptor classes evaluated in the HHRA included current resident, future resident, trespasser, construction worker, rancher, industrial worker, recreator swimmer, and trespasser swimmer. Specific pathways considered during the HHRA included direct dermal contact with surface soil, incidental ingestion of surface soil, inhalation of surface soil, dermal contact with surface water, and incidental ingestion of surface water. The risk assessments were implemented according to appropriate guidance and methodologies, which along with the detailed results from the assessments, were previously presented in the STSIU HHRA and ERA reports (Gradient 2008; NewFields 2006a, 2008).

NMED, after reviewing the HHRA and ERA, concluded that arsenic, copper, and iron are potential soil-based risk drivers for at least one human receptor evaluated, and that copper and pCu are potential soil-based risk drivers for at least one ecological receptor evaluated for the STSIU. The Gradient HHRA and NewFields ERA will be discussed in detail in Section 3.1.1.

Based on the findings from the STSIU RI Report, HHRA and ERAs (SRK 2008a,b, Gradient 2008, NewFields 2006a, 2008), the RAOs for the STSIU include:

- Protection of human receptors, as represented by current and future resident or industrial workers, from exposure to arsenic, copper and iron from ingestion of contaminated soil.
- Prevent the ingestion of copper by the small ground-feeding bird (SGFB) receptor at levels that result in unacceptable population-level risks.
- Toxicity to vegetation or other biological elements of habitat should be reduced to levels that allow for a self-sustaining ecosystem and prevent adverse impacts on local wildlife populations or subpopulations. In areas where habitat function is degraded due to toxicity of elevated copper concentrations and/or decreased pH from either smelter emissions or contamination released from tailings impoundments, remedial actions should focus on the restoration of wildlife habitat. Newfields (2006b) also indicated that “risk management actions to protect wildlife and wildlife habitat should recognize the impacts of other land-uses such as grazing”.
- Restore water quality to water quality objectives that are protective of beneficial uses within reasonable timeframe and maintain existing water quality that complies with water quality objectives. RAOs should reduce the likelihood of contact between surface water and soils/sediments that contain heavy metal contaminants at concentrations that could cause deleterious effects to aquatic receptor populations.

2.4 Pre-FS RAC

In a letter dated September 16, 2010 and then amended via a dispute resolution letter dated March 3, 2011, NMED provided Chino with a Pre-FS RAC for the STSIU (NMED 2010a, 2011a). Based upon the information documented in the ERA, HHRA, as well as the comments and input provided from all parties, NMED has determined the Pre-FS RAC values for soil and surface water as discussed below.

Surface Soil

NMED has determined a Pre-FS RAC for metals that potentially pose human health and ecological risk based on the information documented in the ERA, HHRA, and probability analysis. NMED established HHRA Pre-FS RAC values for arsenic, copper, and iron as follows:

- Arsenic: NMED selected the cancer target risk with a Pre-FS RAC of 27 mg/kg. This value is supported by the probability analysis (Arcadis 2010c,d,e) and is consistent with the range of arsenic clean-up levels previously set in New Mexico by USEPA.

- Copper: NMED selected the non-cancer risk human health Pre-FS RAC as previously determined for the HSIU of < 5,000 mg/kg copper at private, commercial, and public developed properties.
- Iron: NMED selected the non-cancer risk Pre-FS RAC based on the probability analysis (Arcadis 2010c,d,e) of 100,000 mg/kg.

NMED established ecological Pre-FS RAC values for copper as follows:

- To reduce soil toxicity to plants from copper to pCu ≥ 5 where copper is > 327 mg/kg.
- To reduce soil toxicity to SGFB of 1,600 mg/kg. The SGFB Pre-FS RAC is applicable to the 95UCL of the area-weighted average concentration of copper in surface soil (0-6") within exposure units in the STSIU. In addition, NMED required monitoring for copper concentrations in surface soil between 1,100 and 1,600 mg/kg.

Based on the final Pre-FS RAC issued in a letter dated March 2011, NMED stated:

> *Since the FS and ROD will be completed consistent with the NCP, new information can be used to refine RACs and selection of alternatives. This is supported by the NCP in §300.430(e)(2)(i) which states "Establish remedial action objectives specifying contaminants and media of concern, potential exposure pathways, and remediation goals. Initially, preliminary remediation goals are developed based on readily available information, such as chemical-specific ARARs or other reliable information. Preliminary remediation goals should be modified, as necessary, as more information becomes available during the RI/FS. Final remediation goals will be determined when the remedy is selected. Remediation goals shall establish acceptable exposure levels that are protective of human health and the environment…" It must be noted that NMED's pre-FS RACs are equivalent to preliminary remediation goals referred to in the NCP.*"

Thus, Pre-FS RAC are consistent with the use of PRG by USEPA in the NCP, and new information can be used to refine the Pre-FS RAC and selection of alternatives. Additional information is provided herein in Section 1.3 and Appendices A, B, C and D. As discussed in Section 1.3, based on discussions and field work conducted with NMED, soil sampling and vegetation community measurements were conducted in 2018 from new agreed-upon locations. Results were incorporated into calculations of DELs and PELs presented in the phytotoxicity study for four soil/topographic categories (see Section 3.1.5 in Appendix C, referred to as soil categories in this FS). The average PELs for pCu across the soil categories ranged from 4.0 to 4.98, with the highest values in the flat rocky soil category. Based on this new information, the PELs are used to identify acres for remedial alternative evaluation herein. Moreover, percent cover, richness and OAT are used to further identify poor rangeland as described in the approved FS Work Plan (Arcadis 2011a).

In cases where the above criteria overlap for a given area, the constituent which requires the largest remedial footprint will be considered the "risk driver" and the remedial technology will be selected to address this "driver". The selected remedial technology will be evaluated to confirm that all "non-risk driver" constituents are in compliance with their respective RACs. With the issuance of the Pre-FS RAC, constituents identified in the RI and risk assessment as COPCs are now considered constituents of concern or COCs. The FS and ROD will be completed consistent with the NCP. Final remediation goals will be documented in the ROD.

Surface Water

NMED selected the Pre-FS RAC for surface water based upon the State of New Mexico Standards for Interstate and Intrastate Surface Waters, Part 20.6.4 NMAC for risk to aquatic life. The Pre-FS RAC for all constituents is Part 20.6.4 NMAC, including all approaches and tools listed in the Code which provide options for site-specific application. New Mexico promulgated rulemaking to codify the application of site-specific criteria for copper and also to codify the use attainability of the drainages, see §20.6.4.808 – 809.

Ground Water

NMED (2010a) discovered a data gap in the RI Report during the preparation of Pre-FS RAC letter. Drainage sediment sample results exceed the NMED Dilution Attenuation Factors (DAF) developed to protect ground water. Although this potential impact was included in the conceptual site model (CSM) as insignificant (along with sediment, Figure 3-1) and in the risk assessments, NMED requested Chino to further investigate this potential pathway. NMED requested that Chino collect additional samples from all the drainages that currently exceed the DAF 1 or exceed background concentrations for the following COPCs: arsenic, barium, cadmium, copper, iron, molybdenum, and selenium.

Chino submitted a work plan on October 20, 2010 and NMED approved the work plan on November 10, 2010. Chino implemented the work plan in December 2010 with NMED participation. The samples were analyzed using 1) Synthetic Precipitation Leaching Procedure and 2) Acid-base Accounting and the results were compared to Ground Water Quality Standards to determine if this potential pathway may impact groundwater and if potential remedial alternatives should be developed in the FS. The results showed that there is no risk associated with sediments leaching to groundwater; therefore, groundwater will not be evaluated as part of the STSIU FS. The results from the sampling effort were presented in the *Groundwater Quality Pre-Feasibility Study Remedial Action Criteria for Drainage Sediments* (Arcadis 2011b).

2.5 AOC Study Boundaries

As specifically described in the AOC Scope of Work (NMED 1994), the STSIU includes all areas containing and proximal to Chino's copper smelter including the slag, all areas containing or which contained facilities ancillary to the primary smelter, and the soil adjacent or impacted by the tailings facility (excluding the HSIU). The investigation area is contained in section 31 of T18S, R12W and sections 4, 5, 6, 7, 8, 9, 16, 17, 18, 19, 20, 21, 28, 29, 30, 31, 32, and 33 of T19S, R12W. The above township-range sections, as shown in Figure 2-1, include the town of Hurley, Chino operational area, and all tailings ponds; however, the town of Hurley and the former Hurley Operations Area are excluded from the Investigation Unit because applicable remediation or closure of these areas are covered under separate regulatory activities. The western extent of the 1994 AOC area is Highway 180, the eastern extent is approximately a quarter mile east of the toe of Tailings Pond 7, and the southern extent is approximately 1 mile south of Tailings Pond 7.

The former Hurley Smelter was decommissioned and demolished in 2007. The Hurley Operations Area is bounded by the Town of Hurley to the west, Whitewater Creek to the northeast, Lake One to the east, and the tailings impoundments to the south. Current land uses adjacent to the former Hurley Operations Area are residential in the towns of Hurley and North Hurley, tailings disposal south of the operational area, and livestock grazing elsewhere. Chino owns the majority of land included in the STSIU and the majority of this land is currently leased for livestock grazing.

The above investigation area has been expanded over the last 15 years as sampling events have delineated the boundaries of the smelter impacted soils with greater accuracy. The current smelter investigation area now includes areas to the north, east, and west of the original Smelter Investigation Unit located in section 31 of T18S, R12W that have copper concentrations greater than the established background value of 327 mg/kg.

3. Description of Current Situation: Soil

The following sections describe the current understanding of the physical characteristics of the STSIU surface soil based on previous field investigations.

- Section 3.1 summarizes the conceptual site model,
- Section 3.2 addresses how the Pre-FS RAC may be applied across the relatively expansive area encompassed by the STSIU as exposure units, and
- Section 3.3 discusses the upland areas that require potential remedial action as a result of the evaluation.

3.1 Conceptual Site Model

The CSM for sources associated with the STSIU was originally presented in the RI Proposal for STSIU (SRK 2004) as well as in the risk assessments (Gradient 2008, NewFields 2006b, 2008). Figure 3-1 illustrates a CSM via pathway segments and mechanisms required to understand how potential contamination occurred, including the source, release and transport of mineral processing constituents. Primary sources listed in this CSM are historical mineral processing activities and tailing impoundments including historical and current facilities.

Soils within the STSIU were affected by historical stack and fugitive dust emissions from historical mineral processing activities associated with the former Hurley Operations area and the tailings area. The AOC Background Report (Chino 1995) identified the primary sources of contamination in the former Hurley Operations Area resulting from historical smelting, milling, concentrating, and handling of copper bearing material. For the tailings area of the STSIU, the tailings impoundments are considered the primary source of constituents of interest that have the potential to affect environmental media. Both historical and currently operational tailing impoundments may have affected surrounding media. Pathways such as historical run-off and fugitive dust emissions transported constituents in tailings to surrounding soil, drainages, and groundwater. Fugitive dust emissions from the tailings ponds occur when high winds mobilized tailings resulting in transport and subsequent deposition of constituents to the surrounding soil. For groundwater impacts, the state discharge permits, DP-484 and DP-1340, require addressing any groundwater impacts from the historical or current impoundments that infiltrated to groundwater under a sitewide abatement program (Golder 2016). Groundwater impacts are addressed under that program rather than in this FS under the AOC. Groundwater for the STSIU under that program is addressed through monitoring on a periodic basis to ensure it meets permit conditions. Sediment leaching to groundwater was evaluated via request by NMED (NMED 2010a), an approved work plan (Arcadis 2010f, NMED 2010b), a report (Arcadis 2011b), and an approval letter from NMED that sediment does not need to be evaluated in the FS (NMED 2011b).

Prevailing winds tend to be from the northwest (Chino 1995); therefore, surface soils in areas to the south and east of the former Hurley Operations Area and the tailings impoundments are likely to have been the most affected by dryfall from these aerial sources. Following airborne deposition onto soils, metals and other inorganic constituents may be further redistributed by a combination of physical (air and water erosion) and/or chemical (leaching) processes. Windblown tailing (WBT) deposition onto soils currently accumulates south and east of the active Tailing Pond 7 (TP 7) operations within its operational boundaries as well as onto acres investigated under the AOC but within the Mining Permit Boundary. Chino addresses this TP 7 affected area in the recently updated CCP, Section 6.3 (shown in Figure 12 and Plate 25 of the CCP, see Figures 3-2a and 3-2b) (Chino 2024) as described below. The WBT areas shown on Figure 3-2a and 3-2b addressed in the CCP will not be considered for remedy in this FS due to on-going operations.

> **CCP - 6.3.6 Miscellaneous SMA Reclamation Areas**
>
> "Wind-blown tailings were identified east and south of Tailing Pond 7 within the Tailing Investigation Unit under the Chino Administrative Order on Consent (AOC). The AOC investigation and feasibility study based on 2007 and 2011 sample data determined that there are no ecological or human health risks, nor are there communication of constituents to groundwater. However, the tailing deposition sources from the currently active Tailing Pond 7 operations, and those affected acres fall under the operational and closure permit boundaries. These deposition sources are not part of the AOC's definitions for investigation. Thus, this CCP update includes removing an average of 6 inches of windblown tailing from the affected area, ripping the exposed substrate, and revegetating." For the FS, areas east of TP7 are assessed but will not be considered for FS remedy due to proximity to current operations effects. Chino operations have implemented additional source controls to address the higher lifts of Tailing Pond 7 and decrease any wind-blown effects. Additionally, Chino is currently evaluating the construction of another tailing pond to the south of TP7 and in Whitewater Creek basin; however, the permit application process has not been initiated with NMED, and the expansion is not addressed in this FS.

Areas retained for remediation were evaluated for overlap with the windblown tailings polygon in Figure 3-2a and were removed from remediation if they fell within the polygon.

Figure 3-1c identifies the following potential release mechanisms associated with affected surface soil:

- Aerial dispersion of dust and re-suspension:

  Mobilization of affected surface soil to air by wind;
- Run-off: Transport of suspended or dissolved constituents in surface water run-off. Potentially affected sediments may be generated as a result of surface water erosion of surface soil;
- Infiltration: Infiltration of surface water through affected surface soil may potentially release constituents of interest from affected surface soil into groundwater; and

The potential soil exposure routes for current and future human receptors include:

- Inhalation of dust;
- Ingestion of contaminated soil (incidental) and food items from garden foods or animals grazing on the soil; and
- Direct contact (dermal).

The potential exposure routes for current and future ecological receptors include:

- Direct contact (root uptake); and
- Ingestion (contaminated biota and soil).

The above potential human health and ecological exposure routes were evaluated in the STSIU HHRA (Gradient 2008) and STSIU ERA (NewFields 2008). Since the completion and approval of the risk assessments, the STSIU has been naturally "limed" by the "white rain" event as described in Section 1.3. This natural event has shifted the geochemistry of the soils and affected the bioavailability of contamination in the STSIU, as documented in the *Year 5 pH Monitoring Report for STSIU* (Arcadis 2023).

In addition to the white rain event, historic sources to STSIU were fully reclaimed, as described further below in Section 3.1.2.

3.1.1 Previous Investigations

The upland soil in the STSIU was evaluated in the STSIU RI (SRK 2008a,b), the HHRA (Gradient 2008), and the ERA (NewFields 2008) prior to the development and issuing of the Pre-FS RAC. The following sections summarize the findings of these three reports.

Remedial Investigation

The STSIU RI Proposal was completed by SRK in 2004 and the RI Report was submitted in 2006 and resubmitted in 2008 with supplemental data (SRK 2008a,b). Surface soil samples were taken at 165 locations in the STSIU during the RI sampling efforts (SRK 2008a,b).

The RI concluded that copper is the primary metal elevated in surface soils in the STSIU. In addition, arsenic, cadmium, and iron were also detected above the decision criteria, but their respective concentrations largely fall within the range of reference, and elevated concentrations of these metals generally fall within the footprint of copper concentrations. Consistent with conclusions reported in the AOC Background Report (Chino 1995) and the *Phase II Remedial Investigation Report for the Ecological Investigation Unit* (Arcadis 2001), copper concentrations in surface soil exhibit strong spatial characteristics with decreasing concentrations as distance in the direction of prevailing winds increases (SRK 2008a).

Human Health Risk Assessment

In 2008, Gradient evaluated the risks to human health posed by constituent concentrations in the STSIU. Gradient calculated both cancer risks and non-cancer hazards for potential receptors on the site. The methodology used for this risk assessment was consistent with USEPA guidelines and used conservative, default assumptions, whenever site-specific data were not available. The receptors evaluated in the HHRA included current and future residents, adolescent recreators, adolescent trespassers, ranchers, construction workers, and industrial workers. The upland risk assessment evaluated exposures to soil, windblown dust in air, and locally produced food items.

Gradient indicated that site exposure to soils could result in unacceptable cancer risks for current and future residents in all five exposure areas of the STSIU that they delineated and evaluated. However, these cancer risks are largely driven by the consumption of locally grown foods. Gradient stated that the “consumption of locally grown food” pathway was evaluated using conservative assumptions and tends to overestimate risk. Gradient also found that 90% of the excess lifetime cancer risk is attributed to arsenic. All other receptors (recreators, trespassers, ranchers, construction workers, and smelter workers) did not have unacceptable cancer risk. Furthermore, all residential non-cancer risks in the STSIU were lower than residential reasonable maximum exposure non-cancer hazard calculated for the reference area. All other receptors (recreators, trespassers, ranchers, construction workers, and smelter workers) had acceptable non-cancer hazards.

Gradient evaluated copper risks separately using a probabilistic method, only for ingestion of soil. The most sensitive endpoint for copper toxicity is nausea; therefore, copper risks were based on estimating the annual number of nausea episodes that an individual might experience, at a given soil copper concentration. Overall, the industrial worker in the smelter area had the highest copper risk, with an estimated 65 nausea events per year.

Based on the results, NMED established human health RACs for three constituents, including arsenic, copper, and iron, as discussed in Section 2.4.

Ecological Risk Assessment

The Site Wide ERA (NewFields 2006a) was completed and used as the basis to streamline the Investigation Unit -specific ERA for the STSIU (NewFields 2008). These ERA reports evaluated the risks from soil to terrestrial receptors. The methodology used for this risk assessment was consistent with USEPA guidelines, and used conservative, default assumptions, whenever site-specific data were not available. The methodology and parameter selection are described in Technical Memo 1 – ERA Workplan and the sampling and analytical approach are described in Technical Memo 2 (Schafer and Associates 1999a, 1999b). The receptors evaluated in the terrestrial ERA included terrestrial vegetation, herbivorous birds, omnivorous birds, raptors, herbivorous mammals, omnivorous mammals, ruminants, and mammalian predators. The risk assessment evaluated exposures from direct contact, incidental soil ingestion, and ingestion of prey items.

It was concluded that the risks to plants and wildlife were primarily related to elevated copper concentrations and depressed pH in soil (NewFields 2008). The risks to the SGFB, the most sensitive receptor evaluated, appear to be elevated in the STSIU due to exposure to copper. The potential for risk, for both plants and the SGFB, is greatest in the areas immediately to the east of the smelter and the tailings impoundments and decreases with the increased distance to the east of those features.

Since 2008, when the NewFields STSIU ERA was approved by NMED, there has been further analysis of the risk to the SGFB. The following studies and updated exposure parameters have led to a decrease in predicted exposure levels for the SGFB.

- Ingestion Rate of Food and Soil: The ingestion rates used by NewFields in the ERA were updated to more recent allometric-based values in the literature (Nagy 2001).
- The dose equation was updated to model all potential dietary intakes in dry weight.
- Insect tissue concentrations: Additional insect tissue was collected in 2010 to supplement the tissue that was collected and analysed for in the ERA. The results of this sampling event are presented in the *Terrestrial Invertebrate Copper Bioaccumulation and Bioavailability Study* (Arcadis 2010a).

The reason the invertebrate study was conducted was to further refine the conceptual model of copper bioaccumulation into and bioavailability of invertebrates in the Site Wide ERA (NewFields 2006a). Chino developed and NMED approved the *Terrestrial Invertebrate Copper Bioaccumulation and Bioavailability Study for STSIU* (Arcadis 2010a), and subsequently field data were collected with NMED. The results of this investigation indicate that exposure levels from the invertebrate diet were lower than reported in the ERA for the SGFB. Specifically, incorporating the data from the terrestrial invertebrate bioavailability study changed the risk analysis such that the avian pre-FS RAC for the STSIU was increased from its initial proposed value of 626 mg/kg based on the sitewide ERA and STSIU ERA to 1,600 mg/kg for soil. This information was incorporated into the pre-FS RAC (Arcadis 2011d).

Other Risk-Related Assessments

As summarized in Section 1.3, the amendment study, pH monitoring report, and draft phytotoxicity report, were submitted subsequent to the approval of the FS Proposal, and all three are referenced herein as Appendices A, B, and C, respectively.

3.1.2 Previous Reclamation and Interim Actions

The Hurley Mill was closed in 1985 and the Smelter was closed and demolished in 2003 and 2007, respectively. The historical mineral processing operational area was fully reclaimed with 3 feet of borrow fill including slag, improving overall air quality, and eliminating the source of acid and copper to STSIU soils. Closure plans were implemented under DP-1340 for the reclamation of historical tailing impoundments (Tailings Pond 1, 2, B, C, 4, 6E and 6W) (Golder 2013a,b). The Town of Hurley, which is located in the HSIU, was remediated in 2006 and 2007. In addition, also under DP-1340, Condition 90, the Lake One Closure Plan was submitted to NMED in December 2012, approved by NMED, and implemented in 2013 (EMC^2 2014). Borrow fill for reclamation was taken from within the STSIU boundaries, outside of the operational footprint as discussed in Section 1.3.

Additionally, interim actions were completed in 2008 and 2012, as summarized in the *STSIU Interim Removal Action Completion Report* ("Golf Course IRA") and the *Supplemental STSIU Interim Removal Action Completion Report ("Railroad IRA")* (Arcadis 2009 and Golder 2013c). Specifically, these areas included the area west of Highway 180, the South Golf Course, the North Golf Course, the Alley Way adjacent to the South Golf Course, the area east of Highway 180, and other sites located at the end of the South and North Golf Courses. The objective of the interim actions was to remove soils where copper concentrations were greater than 5,000 mg/kg (lateral delineation) at 0 – 1" based on the 2005 NMED-approved residential RAC for the HSIU (and later formally issued in 2011 as pre-FS RAC for STSIU), as the acres were deemed future residential as extensions of the town of Hurley and fall within the current city limits. Within the areas with higher than or equal to 5,000 mg/kg, soils were removed vertically until the copper concentrations were less than 2,700 mg/kg or resistance met.

Later interim actions were also completed in 2014 and 2019 as summarized in the *STSIU Razorback Ridge Interim Remedial Action Completion Report* (Golder 2015) and *the B-Ranch Interim Remedial Action Completion Report* (Arcadis 2021). The Razorback Ridge IRA is located east of Lake One in areas adjacent to the Whitewater Creek Diversion Channel and James Canyon. The B-Ranch IRA is located adjacent to the reclaimed slag and the Golf Course IRA with Whitewater Creek bounding the east side of the site. The objective of the IRAs was to remove soils in areas with copper concentrations higher than 5,000 mg/kg, delineated laterally, as per the STSIU pre-FS RAC. As the soil removed from the Razorback Ridge Area was being utilized as borrow fill material, removal depths were at 1 to 2 feet depth and only post removal sampling was performed. Post-confirmation and post-removal data associated with the above-described removals were incorporated into Chino's maps and databases, as summarized in Table 3-2.

3.1.3 FS Proposal Data Collection

The FS Proposal summarized additional sampling needed to refine the potential remedial areas for all constituents that exceed their respective Pre-FS RACs (Arcadis 2011a). Additional soil samples were collected to more accurately define the current extent of contamination for copper and pCu in surface soil. The exact sampling locations and methods were presented in the Upland Sampling Work Plan (Appendix A) of the FS Proposal (Arcadis 2011a) and discussed in Appendix D in Section 4.

Additionally, exposure units are delineated via desktop evaluation with field verification. The Upland Sampling Work Plan (Appendix A) of the FS Proposal described the methodology that is used to perform rangeland and drainage habitat surveys to better understand the potential habitat units in the STSIU. NMED required that the SGFB copper Pre-FS RAC be applied as a 95UCL area-weighted average (defined in next section) over a habitat unit. Through use of vegetation alliance polygons (Daniel B. Stephens & Associates [DBS&A] 1999, NewFields 2006a), SGFB habitat units are defined for the STSIU and presented herein. Similarly, the pCu Pre-FS RAC is applied as an average concentration over a habitat unit. These copper and pCu exposure units are described in detail in Section 8 of Appendix D. Datasets and exposure units are summarized below in Section 3.2.

3.2 Nature and Extent of Contamination

According to the AOC, the soils of concern in the STSIU are the areas that exceed the Pre-FS RAC values described in Section 2.4 of:

- < 5,000 mg/kg copper at 0-1” bgs,
- 1,600 mg/kg copper area-weighted 95UCL of the mean surface soil concentration for a habitat unit for 0-6” bgs,
- 27 mg/kg arsenic at 0-1” bgs, and
- 100,000 mg/kg iron at 0-1”.

A “95UCL” is the upper end of a confidence interval around the mean concentration, where the confidence interval represents a specified probability (95% in this case) that the value of the mean lies within it. It is a conservative estimate (overestimate) of the mean concentration. “Area-weighted” indicates that each sample point’s concentration is weighted by the amount of ground area the sample represents.

In addition to the Pre-FS RAC described above, based upon new information submitted herein and summarized in Sections 1.3 and 2.4, pCu less than 5 with soil copper concentration greater than 327 mg/kg for 0-6” bgs as well as richness, cover and rangeland condition (measured with the OAT score) are used to identify acres of soils of concern.

There were four constituents evaluated (arsenic, copper, iron, pCu) and three constituents (excludes arsenic) that exceed NMED’s Pre-FS RAC for soil in the STSIU. Copper and iron have exceedances of the NMED human health criteria, while copper and pCu fail their respective ecological criteria. Arsenic did not have exceedances. Each constituent is described further in sub-sections below.

3.2.1 Arsenic

The RI dataset consisted of surface soil samples collected from 165 locations (SRK 2008a,b). For this FS, Chino removed 33 samples from the metals analytical dataset due to their location overlapping with interim action areas that were cleaned up to pre-FS RAC standards, as discussed in Appendix D, Section 6.1 (Sample IDs of 64 through 96, Table 3-1), resulting in a dataset of 132 samples available for the FS from the RI. Of the 132 RI surface soil samples with arsenic data not in remediated areas, there are no exceedances of the human health Pre-FS RAC of 27 mg/kg (Table 3-1). Therefore, arsenic will not be further evaluated in the STSIU FS.

3.2.2 Copper

There were 350 pre-IRA surface (0-1” bgs) and shallow (0-6” bgs) soil samples collected to analyze copper in the STSIU through December 2012. These samples were taken during the following investigations: AOC Background Report (Chino 1995), Site Wide ERA (NewFields 2006b), STSIU RI (SRK 2008a,b), and the STISU FS Upland Sampling Plan (Arcadis 2011a). The results from the FS Upland Sampling Plan are discussed in Section 6 of Appendix D. An additional 51 samples were collected between 2012 and 2018 as part of the pH monitoring study

(Arcadis 2023) and amendment study (Arcadis 2017)[4]. Together these 401 samples comprise the copper dataset not including IRA samples and are identified as "pre-IRA" in Table 3-2 (though there was some overlap chronologically in the collection of samples from these studies and the IRAs). Finally, 1,496 samples were collected during four IRAs: Golf Course (Arcadis 2009), Railroad (Golder 2013c), Razorback Ridge (Golder 2015), and B-Ranch (Arcadis 2021). Table 3-2 summarizes all 1,931 copper samples collected in STSIU; development of the copper dataset shown in Table 3-2 is discussed in detail in Section 6 of Appendix D. All IRA delineation and confirmation samples were analysed using x-ray fluorescence (XRF) and corrected using the regression equation based on a subset of the samples analysed by a laboratory. The regression equation and methodology were presented in the IRA Completion Reports. The Razorback Ridge and B Ranch Completion Reports did not report corrected XRF data; however, paired datasets with XRF and laboratory copper results were reported and a regression was developed from those data for this FS and used to correct the data, which are reported in Table 3-2. All borrow areas, which were excavated at depths of 1 to 12 feet, were assumed to have copper concentrations at background, equal to 327 mg/kg. This background value of 327 mg/kg for copper is consistent with the soil copper portion of the pre-FS RAC for plants and was derived from the 95UCL on the 95th percentile concentration of nine upland reference soil samples (see Tables 6-1 and Table 2-1 in the STSIU HHRA [Gradient 2008]).[5] As part of the borrow excavation, some surficial WBTs were also removed but not sampled. Any older samples previously located in these areas were substituted with 327 mg/kg. The 'post-IRA' dataset analyzed in this FS is comprised of 1,851 samples including all copper data shown in Table 3-2 after substitutions for background values where appropriate, with the exception of samples removed due to occurring in inaccessible areas or occurring outside of the extent of the vegetation alliance polygons, or because the sample was from dust wiped off bedrock (as shown in Table 3-2 and described further in Section 6 of Appendix D; binned copper concentrations and source studies for the full post-IRA dataset are shown on Figure D-7 in Appendix D). The risks from copper in the STSIU are driven by exceedances of the pre-FS RAC for both human health and ecological receptors. The human health risks were evaluated with copper sampled in the 0-1" bgs interval, sieved to < 0.25 millimeters (mm). The risk to ecological receptors was evaluated using the soil horizon of 0-6" bgs, sieved to < 2 mm. Historically, most copper samples were sampled from the 0-1" bgs interval to determine potential risk to human health. Using the methodology presented in Appendix A of the FS Proposal (Arcadis 2011a), for ecological evaluations, the copper results from the 0-1" were adjusted to 0-6" using the median ratio between the two depths (0.7 unless in windblown tailing area, where it was 1.5, Table 3-2). This adjustment (described in more detail in Section 6.1 of Appendix D) provided a more robust 0-6" dataset to evaluate the remedial alternatives. The locations and concentrations of the copper samples evaluated in the pre-IRA dataset are shown in Figure 3-2. As shown in Figure 3-2, copper concentrations were the greatest to the east of the historical smelter and decrease with increased distance from the historical smelter's location. There were also areas of elevated copper on the north, south, and west of the town of Hurley from smelting and other historical mineral processing activities. Similar to the elevated areas to the east, copper concentrations to the north, south and west decrease with increased distance from Chino's operational area.

As discussed in Section 2.4, the March 3, 2011 NMED Chino AOC Informal Dispute Resolution STSIU memo states that the copper SGFB Pre-FS RAC value of 1,600 mg/kg is intended as the 95UCL area-weighted average concentration within an exposure unit, and the exposure unit should be delineated based on habitat. The habitat

[4] Samples collected as part of the phytotoxicity and community study (Arcadis 2018) were not included in the pre-IRA dataset evaluated in the FS because the copper dataset collected for the RI provided adequate spatial coverage of the sampling area for this study.
[5] The data were originally from Table 6.4-6 in Chino (1995). The nine upland reference soil samples included seven near the airport and two located 2 miles west of Bayard.

polygons represented by the vegetation alliance map developed by DBS&A (1999) (and referenced by NewFields [2006a]) were used as the exposure units for upland areas (Figure 3-3) as discussed in the approved FS Proposal (Arcadis 2011a).[6] During the 2011 field effort, a subset of the STSIU drainages was evaluated to determine if the avian habitat along the drainage banks was different from the adjacent upland. It was determined that the STSIU drainage banks were not significantly different from the adjacent upland (Section 8 of Appendix D); therefore, the existing vegetation alliance polygons that encompass the upland and banks of the drainages were used as the ecological exposure unit for SGFB, without differentiating between upland and banks of drainages.

The datasets for each exposure unit for the SGFB were obtained by intersecting ArcGIS interpolated copper Thiessen polygons constructed from the post-IRA dataset (includes effect of borrow removal) with DBS&A vegetation alliance polygons (Figure 3-4). Thiessen polygons are the polygons that result from the method used to identify the ground area each sample represents, used to weight the 95UCL (as discussed in Section 3.2). Thiessen polygons are generated from the set of sample points. Each Thiessen polygon defines an area of influence around its sample point, so that any location inside the polygon is closer to that point than any of the other samples. It is a commonly used method of interpolating chemical concentrations across the landscape, and a method that lends itself to calculating 95% confidence intervals as required by the pre-FS RAC. Details on the choice of using the Thiessen polygon method and calculation of the 95UCL are presented in Appendix D, Section 6.2.

All Thiessen polygons with either lab or XRF sample results[7] that exceeded the human health RAC of 5,000 mg/kg have already been remediated (if possible) to be in compliance with the human health RAC. Some sample points in Table 3-2 had copper greater than the 5000 mg/kg RAC but were in areas that could not be remediated, including (1) areas where bedrock was noted and the sample result was dust wiped off the rock, (2) inaccessible steep sloped areas, (3) around infrastructure, or (4) around ROW.

Based on the 1,100 mg/kg monitoring criteria for the avian pre-FS RAC, exposure units (or habitat polygons) which intersected a copper Thiessen polygon with a concentration > 1,100 mg/kg were retained for further evaluation. For each retained exposure unit, a 95UCL area-weighted average concentration was calculated, using 500 area-weighted bootstrapped datasets. Specifically, the copper data in the exposure unit were re-sampled 500 times with replacement, with probability of a sample being selected in the bootstrap sample equal to the relative area of its Thiessen polygon. The 500 datasets were each entered into ProUCL to select the recommended 95UCL for each dataset. The final 95UCL was the average of the 500 95UCLs (Casmalia Resources Site Steering Committee 2011).

Table 3-3 includes the exposure units that have 95UCL concentrations in excess of 1,100 mg/kg. The colors of the exposure units in Figure 3-5 identify which of these post-IRA exposure units require remedial technology evaluation, additional monitoring, or no further action to be in compliance with the avian pre-FS RAC, depending on the 95UCL copper concentration of the unit. All exposure units had 95UCL concentrations less than or equal to the avian RAC of 1,600 mg/kg (ratios ≤1.0 in Table 3-2). Exposure units in yellow have a 95UCL between 1,100 mg/kg and 1,600 mg/kg and will require additional monitoring for the protection of the small ground-feeding bird (vegetation alliance polygons 1-3, 10-16, and 88-15). Exposure units in green do not require any additional action.

[6] Alliance polygon size shifted for several polygons based on updates to the habitat map and an addition of “mine facilities/other” category.
[7] Results based on 0-1” and sieved to < 0.25 mm.

3.2.3 Iron

Two of the 132 soil samples collected for the RI and used in the FS that were analysed by USEPA 6010 exceed the human health Pre-FS RAC of 100,000 mg/kg (Table 3-1). The locations of these samples (SS145 & SS148) are along the eastern border of Tailing Dam 7, as seen in Figure 3-6. The iron results from SS145 and SS148 only slightly exceed the human health Pre-FS RAC with concentrations of 141,000 mg/kg and 123,000 mg/kg, respectively. However, the area encompassing these two sample locations falls within the currently operational Tailing Pond 7 footprint and will be addressed under the CCP and DP-1340. Thus, iron is not retained for further evaluation.

3.2.4 pCu

As discussed in Section 1.3, the results of the 5-year pH Monitoring Study showed that the 2008 white rain benefitted the STSIU soils by increasing the pH and pCu of the acidic soils, making copper less bioavailable. The increase in pCu led to a decrease in the uptake of copper into living organisms, decreased wildlife dietary exposure, and significantly improved plant richness but not plant cover. The potential of STSIU soils to generate acid was found to be consistently low after the white rain through 2014 in most areas, although the long-term persistence of this effect is unknown (Arcadis 2017 in Appendix B). The white rain improved richness on the untreated test plots but did not significantly improve cover (Arcadis 2017 in Appendix A). These changes needed to be considered when estimating the current nature and extent of pCu on the landscape.

Cupric ion activity (pCu) is difficult to measure directly in soil. It was directly measured in 0-6” bgs soil at 17 sites in the STSIU in 1999 in the laboratory and was found to be strongly related (R^2 = 0.97) to copper concentrations and pH in the following equation (upland equation from Sitewide ERA, NewFields 2006b):

$$pCu = 7.34+(0.93*pH)-(1.15*\ln[Cu_{total}])$$

Because it did not require measuring copper activity in solutions, this equation was applied to available total copper and pH data in the soil. The soil was sampled at 0-6” bgs and sieved to < 2 mm and then the spatial distribution of pCu was estimated using an interpolation method (Table 3-4, methods discussed in detail in Section 6 of Appendix D). Only post-white rain samples were used in impacted areas because they best represent current conditions, and remedial decisions should be based on current chemistry of the soils. Of 155 pCu locations, 102 were sampled in the STSIU after the white rain event. However, these 102 samples did not fully cover the outer edges of the STSIU needed to bound the interpolation of pCu across the landscape (prevent the interpolation from erroneously assigning low pCu values on the edges where pre-white rain samples show they are high pCu). Therefore, 56 pre-white rain samples located on the edges were included (see Figure 3-7 and Table 3-4). These 56 samples, though collected pre-white rain, are likely representative of current conditions because they are at the edges of the interpolation where the effect of the lime in the white rain was minimal because they were already well-buffered soils with high pCu, essentially at background levels (all pre-white rain samples used to bound the post-white rain samples had pCu > 5 with the exception of a few locations directly north of Hurley and just east of Tailing Pond 7). This approach is conservative in areas where liming possibly had a small beneficial effect in the STSIU edges. The impacted areas in the non-edge areas that have low buffering capacity and thus benefitted from the white rain were always represented only by the post-white rain samples to avoid recommending remediation in areas that already have been treated with alkalinity from the white rain (had increased pCu above the pre-FS RAC). Areas not included for remediation because the white rain improved pCu will be monitored in the future to ensure the white rain effect was sustained.

Using the above calculated pCu dataset *before* incorporating effects of interim remedial actions, pCu contours and a grid of pCu values across the STSIU were developed using natural neighbor interpolation as shown in Figure 3-8 (see Appendix D, Section 6.2 for details on interpolation method). IRA areas were then converted to pCu of 6, representing a conservative background value after IRAs were completed. As proposed in the FS Proposal, Chino selected the pCu exposure units to be the polygon boundaries defined by combinations of different soil and vegetation types. These are the same boundaries that were used for the rangeland condition analysis in Woodward Clyde (1997) and thus are referred to as “rangeland polygons” (Figure 3-9). The pCu values in the grid that intersected with the rangeland polygons were averaged to obtain the exposure point concentration (EPC) for each polygon.

The process of identifying rangeland polygons considered for remediation (destroys plants initially) to protect plants from pCu exposure was a sequence of steps that not only considered the pCu pre-FS RAC but also considered the current condition of the plant community relative to reference areas in the same soil category and relative to toxicity of a soil category. Plant sensitivity to pCu varies by four soil categories as discussed in the phytotoxicity and community study in Appendix C. The four soil/topography categories (referred to as soil categories) and vegetation survey and associated soil sampling locations from the study are shown in Figure 3-10. They include flat rocky, flat granular, slope > 13%, and bedrock soils.

The sequence of steps for identifying polygons considered for remediation is outlined as follows:

1. Identify rangeland polygons that fail the pre-FS RAC, with mean pCu EPC < 5 in areas with copper > 327 (identified in Figure 3-11 after IRAs). This pre-FS RAC, developed by NMED, is a generic pre-FS RAC applied regardless of soil category.
2. Identify rangeland polygons post-IRA that failed the generic pre-FS RAC that also have unacceptable wildlife habitat or rangeland habitat (Figure 3-12).
3. Identify remaining rangeland polygons that also failed a pre-FS RAC refined to be soil-category specific (Figure 3-13).

The area failing the pre-FS RAC for pCu in step 1, after IRA and borrow area removals, covers 2,459 acres in the STSIU (Figure 3-11). However, the pre-FS RAC to protect plants did not take into consideration whether the plant community in an area with pCu < 5 was of similar habitat quality to reference areas with high pCu. As such, the FS Work Plan outlined an approach for step 2 below for comparing areas to reference and excluding them from consideration for remediation if they have similar characteristics to reference areas, where the characteristics evaluated are important to wildlife and livestock.

Only rangeland polygons that intersected average pCu < 5 and copper > 327 mg/kg (i.e., below the Pre-FS RAC) that failed the criteria outlined below for rangeland and wildlife habitat quality were retained for further remedial evaluation. Rangeland was quantified using the OAT score, and wildlife habitat quality was quantified based on richness and cover of the vegetation community. The OAT method is a rapid assessment technique promoted by the Bureau of Land Management and Natural Resources Conservation Service whereby the investigator walks through a defined area and visually estimates scores based on vegetation vigor and soil condition (explained in detail in Appendix D, Section 5.2). The method was used to estimate “apparent” trend in rangeland condition without sampling more than one time period. A high score represents good rangeland condition.

The criteria outlined below based on OAT score, richness and cover, remove rangeland polygons from remedial consideration where the destruction of the existing vegetation and inevitable increase in soil erosion associated with remediation could lead to a loss of long-term environmental benefits to the vegetation, causing more harm than good.

- Except for bedrock, if the OAT score of the rangeland polygon was ≥ 22 for all soil categories, the polygon was considered to have "fair-good" rangeland condition (acceptable condition) and, therefore, was excluded from further evaluation. If the OAT score was < 22 (or < than 13 for bedrock, see Section 9.3 of Appendix D for details), the polygon's rangeland condition was considered "poor" and it was retained for further evaluation. The cutoff of 22 was based upon data in 1997 rangeland condition datasheets (see Woodward Clyde 1997) showing most rangeland polygons had fair to good condition with OAT ≥ 22 on STSIU, as described in the approved FS Workplan (Arcadis 2011a). The 2011 OAT scores (see Section 5.2 of Appendix D) were used to determine current rangeland condition for this FS.
- If the percent vegetation cover of a rangeland polygon was ≥ a targeted percentage of a reference area mean, the polygon was considered to have "acceptable" cover for wildlife habitat. The targeted percentage was based on variability of the background value of the soil category; the less variable, the higher the target was (closer to the mean value, see Section 9.3 of Appendix D for details on target development). Flat granular soil, flat rocky soil, bedrock (> 60%), and steep slopes (>13% slope) are the four soil categories with different targeted percentages. Unacceptable polygons based on cover were retained for further evaluation.
- Similar to vegetation cover, if the vegetation species richness of a rangeland polygon was ≥ a targeted percentage of a reference area mean, the polygon was considered to have "acceptable" richness for wildlife habitat. Unacceptable polygons based on richness were retained for further evaluation.

OAT scores, percent vegetation cover, and species richness for each polygon were obtained using binary classification techniques on remote-sensing-based maps (Section 7 of Appendix D provides more detail on remote sensing methods to create the maps). The maps were developed from IKONOS satellite imagery that covered the site on September 4, 2011. These maps were classified into two categories: acceptable and unacceptable, as discussed above. Those classification results were then ground-truthed and evaluated for accuracy using the percent cover and species richness that were sampled in the field on 100 ft^2 plots and the OAT score data collected on 200-m transects that were alongside the plots in 2011, 2014, or 2018 (plots are shown in Figure 3-10, see Section 5.2 of Appendix D for details). All field sample locations had been grazed, as almost all of the STSIU has been grazed and, therefore, the criteria for acceptability was based on comparison to grazed reference plots.[8]

All plots with field data for vegetation cover and species richness were used to evaluate map accuracy because the plot locations were independent of the high and low value endpoints used to calibrate the vegetative cover and richness remote-sensing models (calibration of cover and richness is explained in Section 7 of Appendix D). However, for rangeland condition (OAT score), 3/4 of the ground samples were used for training to develop a good classification model and 1/4 of the samples were set aside to be independent and used for accuracy assessment (see Section 7 of Appendix D). The accuracy of the OAT score, vegetation cover, and species richness maps in identifying the two classes (acceptable vs. unacceptable) based on locations independent of the

[8] Based on the FS work plan that specified grazed plots will be evaluated for habitat quality by comparing to reference plots. The initial reference plots included one north- and one south-facing grazed "wildlife reference" plot (Figure 3-10). However, the "wildlife reference plot south" was downgraded to a site plot with "de minimis" impacts after reviewing its pCu estimate when chemistry was later collected (see Appendix C and D) and subsequently was not used as a reference plot. Eight additional reference plots, representing the four major soil categories on the site were sampled in 2018 and, along with previously collected data on two other reference plots (STS-PT-2013-26 and wildlife reference plot north in Figure 3-10) were used to estimate target thresholds, as described in Section 5.3 in Appendix D.

model data was relatively good at 88%, 74%, and 71%, respectively, meeting the FS workplan goal of at least 70% accuracy (Tables 3-5, 3-6, and Section 7.2 in Appendix D).

For the final classification of a rangeland polygon as containing vegetation that may have been degraded in quality by pCu, the polygon had to be rated unacceptable for the OAT score (rangeland condition) or unacceptable for either richness or cover (wildlife habitat quality). The retained rangeland polygons classified as unacceptable (overlaid on the four soil categories) with pCu lower than the pre-FS RAC of 5 where copper is > 327 mg/kg are shown on Figure 3-12. The mapped acres in Figure 3-12 with pCu < 5 that had greater than 327 mg/kg copper that were unacceptable were 230 acres of flat granular areas, 1,097 acres of bedrock, 146 acres of steep sloped areas (steep slope defined as > 13%), and 346 acres of flat rocky soil areas (total of 1819 acres).

The generic pre-FS RAC did not consider sensitivity of a soil category in the field to pCu toxicity. The generic pre-FS RAC is unrefined because it is equivalent to the estimated PEL in the 1999 Site-wide ERA study of toxicity of pCu to growth endpoints of grasses and forbs using greenhouse data and site soils in pots as well as field-based plant community data. The site soils selected in that study represent a narrow range of habitat types, mainly on level or very shallow sloped areas. Much of the STSIU is topographically rugged with varying soil conditions and types not represented by the soils studied in the 1999 ERA. Thus, in 2012, Chino submitted a work plan to further investigate native seeds and soil type in a phytotoxicity study which NMED subsequently approved in 2014 (Arcadis 2014a). NMED agreed with the definition that specifies use of the effects concentration at 50% (EC50) for the PEL based on their comments and Chino's responses, as follows:

- The September 2010 pre-FS RAC letter indicates that the PEL in the Site Wide ERA (Table 2.2-1) was selected as the pre-FS RAC for pCu because the ecological significance of effects between the DEL and PEL is uncertain.
- The phytotoxicity study in Appendix C fit curves to 1999 ERA data (Figures 10 and 11 in Appendix C) that demonstrate that the 1999 PELs in the sitewide ERA upon which the pre-FS RAC was based, approximate an EC50 (e.g., for richness, cover, and shoot weight/height), not a lowest-observed-adverse-effect level.
- An EC50 definition is consistent with USEPA's use of the term "probable effects level" for aquatic sediment toxicity assessments. USEPA endorses using PELs for aquatic toxicity thresholds because they are better at predicting toxicity than ERLs or TELs (effects range low and threshold effect levels similar to DELs), as stated in Long et al. (1998): "the probabilities of highly toxic responses occurring when one or more ERLs or TELs are exceeded and no ERMs or PELs are exceeded are 16 to 18% in amphipod tests alone…. The probabilities of either marginally or highly toxic responses occurring are 48 to 52%...when concentrations exceed one or more ERMs or PELs; consistent with their original intent, the ERMs and PELs are considerably better at predicting toxicity than are the ERLs and TELs." When used for remedial decisions, the threshold should be the more predictive one to avoid causing more harm with habitat destruction than good with reducing COPC concentrations.
- Protection of plants requires different criteria in the southwest than for wildlife because the plants are directly destroyed in the remediation, whether by soil removal or tilling. The destruction of the plants "to benefit plants" and long recovery period required for the entire plant community (decades, see Appendix B-3 in Appendix A) in the semi-arid southwest outweighs the impact of a "low" (DEL) reduction in emergence or survival, difficult to even observe in the field. A reduction at a threshold that creates a more probable effect (PEL), above which a more certain effect occurs, is needed before deciding to destroy the very same species targeted for protection. Protectiveness of the plants as a food source is an important criteria to consider in the FS, which may be lost until the community recovers from remediation.

This approved phytotoxicity and community study was conducted in the field and greenhouse in 2014 and 2015, and all soil categories were evaluated. The soil category was found to change the PEL, and the PEL for each community endpoint (richness, cover, and OAT score) significantly differed among the four soil categories (Section 4.2.1 and Figure 12 in Appendix C). Based on NMED comments on the draft phytotoxicity study, reference soils for each category were also surveyed and sampled in 2018 in order to strengthen the study conclusions (Attachment A of Appendix D). Specifically, while Chino had worked with NMED in September 2012 to compare bedrock areas within the STSIU to an agreed upon reference bedrock area outside of the STSIU, NMED later deemed the area selected to not to be an adequate bedrock reference area because it was found to have pH lower than background (Section 4 in Appendix D). A reference area study was initiated in 2018 to identify adequate reference areas east of the former smelter that would represent all four soil categories, including bedrock (see Attachment A of Appendix D). The reference soils were assumed to represent no toxic effect and the PEL approximated a 50% effect level relative to the reference (following the general approach from the 1999 ERA work).

Because vegetation response to pCu varied by soil category (Section 4.2.1 in Appendix C) and its buffering capacity (Section 9.3 in Appendix D), the retained rangeland polygons after step 2 were further evaluated in step 3 as to whether their average pCu exceeded their respective PEL based on the polygon's soil category, as shown in Table 3-7 and described in Section 10 of Appendix D. For this FS, the PELs were re-calculated from the field community data collected in 2018. The PELs were 4.40, 4.98, 4.11, and 4.11 for bedrock, flat rocky, flat granular, and slope > 13% soil categories (see Section 9.3 in Appendix D for details on methods, data and calculations of PELs) based on selecting the highest PEL for either wildlife habitat (represented by average of richness and cover PELs) or rangeland condition (OAT score).[9] Because vegetation response to pCu varies by soil category (Section 4.2.1 in Appendix C) and its buffering capacity (Section 9.3 in Appendix D), the retained rangeland polygons after step 2 were further evaluated in step 3 as to whether their average pCu exceeded their PEL based on the polygon's soil category, as shown in Table 3-7 and described in Section 10 of Appendix D. If a retained rangeland polygon had an average pCu ≥ its PEL, it was removed from further analysis.

The pCu map in Figure 3-8 represents the post-white rain conditions before interim actions and soil removals described in Section 3.1.2 occurred. The map does not represent current conditions after interim actions. Therefore, areas remediated, reclaimed or with WBT or borrow material removal (shown in Figure 3-13, referred to generically as "IRA" areas) were assumed to have pCu above the pre-FS RAC of 5 because depths over one to 12 feet were excavated (copper and pH effects are in shallower layers). Also, some operational areas that had clean soil such as Bolton Draw diversion were also considered "remediated" and removed. These IRA areas were assigned a pCu of 6 (conservatively representing background) before averaging pCu across map pixels within each rangeland polygon to create a map and table of pCu EPCs by polygon (see Table D-2 in Appendix D for all polygon EPCs in the STSIU). Using the soil category-specific PELs calculated from that reference data, approximately 47, 313, and 17 acres of bedrock, flat rocky, and slope >13%, respectively are retained to consider for remediation (Figure 3-13). All acres of flat granular soils were below the flat granular PEL of 4.11 and thus none in this category were retained.

[9] Basing the calculation on the mean of all three endpoints of richness, cover, and OAT score is a second way one could calculate the PEL that produces lower PELs (see Appendix D, Section 10.2).

3.3 Soil Exposure Units to be Evaluated for Remedial Alternatives

Before evaluating technologies and remedial alternatives, this FS evaluates all exposure units where (1) copper in soil is greater than 1600 mg/kg, (2) copper in soil is within the monitoring range of 1100 – 1600 mg/kg, and (3) pCu in soil fails the pre-FS RAC, acceptability criteria, and PEL comparison for each soil category. All exposure units had a 95UCL area-weighted average for copper less than or equal to the Pre-FS RAC of 1,600 mg/kg (ratios ≤1.0 in Table 3-2), but three units (alliance polygons 1-3, 10-16 and 88-15) summing to 140 acres fell in the copper range for monitoring (Figure 3-5). Nine exposure units summing to 377 acres from the pCu evaluation are retained for consideration for remediation (Figure 3-13).

4. Description of Current Situation: Surface Water

4.1 Conceptual Site Model

As discussed in the AOC Background Report (Chino 1995) and the STSIU RI (SRK 2008a,b), the surface waters[10] and drainages in the STSIU include Bolton Draw (called Drainage C-2 in this FS), Rustler Canyon, Martin Canyon, Lucky Bill Canyon, and other un-named tributaries of Whitewater Creek (referred to by letters) and Lampbright Draw. Previous investigations including the RI and ERA have noted the majority of these drainages are considered ephemeral (Figure 4-2), with surface water flow generally occurring during and immediately after a precipitation event. In 2011, Arcadis applied NMED Surface Water Quality Bureau's (SWQB's) Hydrology Protocol to determine the appropriate hydrologic regime of STSIU surface water drainages. Hydrologic classifications of STSIU drainages were established in the Application of the Hydrology Protocol to STSIU Drainages report (Arcadis 2014b). Non-ephemeral drainages include Rustler Canyon, Martin Canyon, Lucky Bill Canyon, headwaters of Drainage C (upgradient of Bolton Canyon confluence), southeastern portion of Drainage D-1, northern drainage of Lucky Bill Canyon, and the drainage immediately downstream of Ash Springs to confluence with Drainage A. All other STSIU drainage areas are designated as ephemeral. Other than these drainages, the remaining surface water bodies present in the STSIU are livestock watering tanks. The livestock tanks are generally designed to catch surface water run-off and/or spring or well water, and to hold water for extended periods of time.

Fate and Transport of COCs in STSIU Drainages

As discussed in the FS proposal, the primary sources of surface water impacts in the STSIU drainages are due to the presence of COCs in surface water runoff, leaching of COCs from sediments (see conceptual model, Figure 3-1), and possibly re-emergence of subsurface alluvial water.

Surface Water Run-off

For the STSIU drainages, runoff from the upland environment is considered to be a source of potential COC impacts to surface water. COCs from COC-affected soils, from either smelter emissions or fugitive dust, have the potential to be sorbed to/incorporated into suspended particles or dissolved in runoff during precipitation events, leading to increased total and dissolved surface-water concentrations of COCs in the receiving drainages.

Leaching from Sediments

STSIU surface water also has the potential to be affected by the remobilization of COCs from sediments in drainages during stream flow events. Constituents in COC-affected sediments, derived from smelter emissions, historical upland runoff, or fugitive dust, may be remobilized during precipitation events, leading to possible increased total and dissolved surface water COC concentrations in the receiving drainages. In addition, leaching of COCs from COC-affected sediment may occur during times when water is present in a drainage after a storm event.

The leaching potential of sediments in STSIU drainages was evaluated for samples collected at select locations within the STSIU during a December 2010 sampling event, and the results were reported in the *Groundwater Quality Pre-Feasibility Study Remedial Action Criteria for Drainage Sediments* (Arcadis 2011b). These results

[10] The term "surface waters" is used in this document to reflect the common meaning of the term, not any legal meaning. Use of this term is not intended to imply that there has been a determination that any particular surface water or drainage constitutes a "surface water of the state" or "waters of the United States."

demonstrate that, with the exception of copper, sediments in the STSIU drainages do not have the potential to leach COCs to surface water at concentrations that might adversely affect the surface water quality at concentrations above acute aquatic life criteria. NMED approved the report and indicated that sediment does not need to be further evaluated in the FS (NMED 2010b).

Re-emergence of Subsurface Alluvial Water

There are a few locations in the STSIU where subsurface alluvial water is re-expressed as surface water via seeps. If this re-expressed groundwater has COC concentrations that are greater than the NM Water Quality Standards (WQS), then there is a potential that this subsurface alluvial water could have implications on how to manage surface water.

The FS proposal stated that it is unclear which of these three fate and transport mechanisms is driving metals – and specifically copper – loading to STSIU drainages. Appendix E discusses use of stormwater samplers, which were intended to sample run-off to allocate metal loads in surface water to upgradient sources, soil sources, or legacy sediment sources. However, the samplers entrained sediment in the samples not representative of surface water, and the amount of time after storm samples were in the bottle before samples were retrieved was uncertain. These issues led to the study results being inconclusive, and the results do not rule out slope runoff as a primary source of COCs.

Summary

The primary mechanisms for loading of COCs to surface water in STSIU drainages is transport of metals in hill slope runoff (dissolved COCs as well as COCs associated with soil/sediment) derived from COC-affected soil in the STSIU. Since sediments in drainages are derived from hill slopes above the drainage, the presence of COCs in hill slope runoff, surface water, and sediments are intimately linked.

Fate and Transport of COCs in Stock Tanks

Stock tanks that receive the majority of their water from surface runoff are a key focus for the CSM because the COC sources described above for surface water will affect the quality of water in the stock tanks. Stock tanks might also receive water from springs or windmill-pumped groundwater, but these sources do not have a large surface-water runoff component. The water quality in stock tanks may also be affected by the potential regeneration of COCs stored in stock tank sediments.

Surface Water Inflow

Stock tanks receive their water from ephemeral surface drainages, which in turn likely receive the majority of their water from surface runoff. As stated above, there is potential for COCs in soils to be sorbed to/incorporated into suspended particles or dissolved in runoff during precipitation events. In addition, leaching of COCs from drainage sediments and mobilization of COC-affected sediments may occur during the brief period of time when stream flow occurs. These mechanisms may lead to input of dissolved and solids-associated COCs to the stock tanks during runoff events.

Cycling of COCs from Sediments

For stock tanks, the cycling of COCs from sediment to surface water may present a continued source of COC impacts to stock tank surface water. If there is no outflow from a stock tank, all COC-affected sediments transported to a stock tank during a runoff event will accumulate in the stock tank. These COC-affected sediments may present a long-term COC source for stock tank surface water. When a new inflow event occurs, the already present mass of COCs in the stock tank is increased by the constituents present in the incoming surface water.

The combination of COC-affected surface water and the remobilization of COCs from COC-affected sediments in the stock tanks may result in the potential for COCs in stock tank water to exceed surface water criteria.

Summary

The source of the majority of the mass of COCs in stock tank surface water is unknown but likely is derived from inflow during runoff events. Cycling of COCs from COC-affected sediments that accumulate in the stock tanks may result in release of additional COCs to surface water in the stock tanks.

Surface Water Conceptual Site Model

STSIU surface water, contained in drainages and stock tanks, has the potential to be affected by runoff interacting with COC-affected surface soil and sediment during storm events, and ongoing leaching of COCs from COC-affected sediments during times when water remains within a drainage or stock tank.

The CSM for STSIU surface waters (Figure 3-1) identified the following potential exposure pathways for current and future humans associated with COC-impacted surface water:

- Direct Contact: Exposure associated with direct dermal contact with affected surface water;
- Ingestion: Exposure associated with incidental ingestion of affected surface water, and COCs from affected surface water might bioaccumulate in foods that could be consumed by grazing animals. COCs could, in turn, be ingested through consumption of these animals.

The potential exposure routes for current and future ecological receptors include;

- Direct contact (dermal contact, aquatic organism contact with water);
- Ingestion (drinking water and diet-borne exposure of food sources drinking water).

The above potential human health and ecological exposure routes were evaluated in the STSIU (Gradient 2008) and ERA (NewFields 2006a, 2008).

4.1.1 Previous Investigations

Remedial Investigation

The STSIU RI was completed in 2004, and then revised with the inclusion of new data and resubmitted in 2008 (SRK 2004; SRK 2008a). Twenty-four surface water samples were collected at 16 locations in the STSIU and were used to evaluate surface water quality during the RI (SRK 2008a). Those results were presented in the Addendum to the RI (SRK 2008b).

During the RI sampling, aluminium, barium, beryllium, boron, cadmium, calcium, cobalt, copper, iron, lead, manganese, molybdenum, nickel, vanadium, and zinc were detected in STSIU surface waters. Of these detected constituents, only cadmium, copper, and lead were detected at concentrations that exceeded the chronic aquatic life criteria at that time (SRK 2008b). Lead concentrations were not detected above acute aquatic life criteria. Cadmium concentrations exceeded acute criteria in three drainage locations and two stock tanks. Copper concentrations were consistently above acute criteria in drainage and stock pond locations.

Human Health Risk Assessment

The HHRA (Gradient 2008) evaluated data generated from surface water samples collected within the STSIU. The risk assessment calculated cancer risks and non-cancer hazards for potential receptors on the site. The methodology used for this risk assessment was consistent with USEPA guidelines and used conservative, default assumptions whenever site-specific data were not available. Gradient evaluated two dermal contact scenarios, the recreational swimmer and the trespasser swimmer in stock ponds, to determine the potential risk from exposure to STSIU surface water. They also evaluated incidental ingestion of water during swimming.

Gradient determined that site exposure to surface water did not result in unacceptable cancer risks or non-cancer risks for either the recreational swimmer or the trespasser swimmer scenarios for any COCs identified for the STSIU.

Ecological Risk Assessment

The ERA (NewFields 2008) evaluated the risks from surface water to aquatic receptors in the STSIU.[11] The methodology used for this risk assessment was consistent with USEPA guidelines and used conservative, default assumptions, whenever site-specific data were not available. The receptors evaluated in NewFields' ERA included amphibians, aquatic invertebrate communities, and fish communities.

The ERA showed that where surface water exists in the STSIU, the COCs of most concern were cadmium, copper, and lead (NewFields 2008). These three constituents exceed the chronic aquatic life NM WQS and/or the selected amphibian TRVs (Harfenist et al. 1989; Schafer and Associates 1999a) at one or more RI surface water locations.

NewFields (2008) concluded that where water is present in the STSIU, copper concentrations are elevated above acute and chronic water quality criteria at most locations. Risks to aquatic life from copper in surface water are predicted for the limited aquatic habitat within the STSIU. However, the risks to aquatic receptors from chemical exposure need to be qualified given the overall physical quality of the aquatic habitat. Without persistent aquatic habitat in the area, aquatic life is limited to invertebrate species that breed relatively rapidly in water and to potentially breeding amphibians and their larval offspring, particularly in the stock tanks. Fish have not been observed in any surface water features associated with the STSIU, except in Rustler Canyon during a 2007 sampling event (NewFields 2008). Therefore, as stated by NewFields (2008), the risk estimations presented for aquatic life are highly uncertain.

Remedial Investigation Technical Memorandum

The STSIU RI Surface Water Sampling and Analysis of Rainfall Pools Addendum was completed in 2008 (Chino 2008). Seventeen surface water samples were collected at surface water drainage and stock tank locations in the STSIU. These samples were used to evaluate occurrence of select metals (aluminium, cadmium, copper, iron, lead, and manganese) within different size fractions based on filter pore size and to assess potential associations of metals with dissolved organic matter.

During the RI Addendum sampling, all of the analysed metals were detected in surface water samples, but only aluminium, cadmium, and copper were detected at concentrations that exceeded the chronic aquatic life criteria (Chino 2008). Aluminium and cadmium were primarily associated with particulate form and were mostly excluded by filtration with 0.45 micron filter pore size. Concentrations of copper generally decreased with decreasing filter size fraction. However, ultra-filtered (~0.001 micron effective pore size) copper concentrations exceeded aquatic life criteria for about one half of the locations. Copper concentrations were positively correlated with dissolved organic carbon (DOC) concentrations, suggesting that copper may be bound with DOC and thus may have a

[11] Risk was higher from surface water than sediments (NewFields 2008). Sediment exposure is deemed a relatively insignificant pathway with no pre-FS RAC so not addressed in the FS (NMED 2011b).

lower toxicity. Based on these results, a more formalized surface water toxicity study was undertaken, as described in the following section.

Water Effect Ratio Study

As discussed in Section 1.3, Arcadis conducted a copper WER study for the STSIU surface waters in 2011 and results from the WER study were described in the *Development of Site-Specific Copper Criteria Interim Report* submitted to NMED in March 2013 (Arcadis 2013a). WER study locations are shown in Figure 4-1. A site-specific copper WER model was subsequently developed to derive adjusted copper criteria in STSIU surface waters in the *Revised Site-Specific Copper Toxicity Model Report* submitted to NMED in October 2013 (Arcadis 2013b). The site-specific criteria for STSIU surface waters were adopted by NMED and are contained in NMAC §20.6.4.808 - 809.

Hydrology Protocol Use-Attainability Analysis

In 2011, Arcadis conducted a Use Attainability Analysis (UAA) based on NMED SWQB's Hydrology Protocol to determine the appropriate hydrologic regime of STSIU surface water drainages. Hydrologic classifications of STSIU drainages were proposed in the draft *Application of the Hydrology Protocol to STSIU Drainages* report submitted in October 2012 (Arcadis 2012). The report was finalized in 2014 after review and comment from the New Mexico Surface Water Quality Control Board and field reconnaissance by the Ground Water Quality Control Board as well as by NMED (Arcadis 2014b). The hydrologic classifications of STSIU drainages are depicted in Figure 4-2. Non-ephemeral drainages identified in the Hydrology Protocol UAA include those in Rustler Canyon, Martin Canyon, headwaters of C-1 (Bolton Canyon), southeastern portion of Drainage D-1, headwaters of C-2 (Bolton Draw), and drainage immediately downstream of Ash Springs to confluence with Drainage A. All other STSIU drainage areas in the UAA study area[12] are designated as ephemeral and were treated as ephemeral in this FS. Conclusions regarding use attainability analysis were promulgated by NMED, see NMAC §20.6.4.808 for list of intermittent/perennial drainages and §20.6.4.809 for list of ephemeral drainages.

2010, 2011, and 2013 Wet Season Surveys

Before the WER study work plan was developed, a preliminary 2010 Wet Season Survey was conducted to gain a better understanding of water persistence, copper toxicity, and water chemistry variability in the STSIU surface water drainages (Arcadis 2013a). A total of 12 STSIU surface water samples were collected in the 2010 study. Surface water samples collected were analyzed for a complete set of water chemistry affecting metal bioavailability, including parameters such as total and dissolved organic carbon, alkalinity, and total dissolved solids. Previous site investigations included only a limited number of chemical parameters, which precluded estimation of site-specific metal toxicity using predictive models such as the biotic ligand model. In 2011, in addition to the WER study sampling, five samples were collected to increase the spatial distribution of these full set chemistry samples in the STSIU (no toxicity tests were performed on the water at those locations). In August 2013, a year with more rainfall, additional full set chemistry sampling was conducted to further understand the variability in surface water chemistry with the collection of 13 more samples. In Appendix E of Arcadis (2013b), 48 locations were evaluated (including the WER locations), with the purpose of assessing whether the chemistry range used to develop the WER model sufficiently represented the range of water chemistries in the STSIU study area (2010 to 2013 data in Tables 4-1 to 4-3). The analysis showed that the ranges of chemistry parameters used to develop the WER model were representative of STSIU surface waters.

[12] Lucky Bill Canyon was not in the UAA study area.

Surface Water Runoff Quality and Duration Sampling

Appendix E documents the collection and analysis of surface water runoff samples proposed in the STSIU FS Proposal (Arcadis 2011a). The objectives of the surface water runoff investigation included providing additional surface water quality data to support refinement of the conceptual site model and to support the STSIU FS. The objectives of the sampling also included defining the duration of flow and presence of water to support classification of drainage channels in the STSIU. However, the data associated with the duration of flow and presence of water were used in the expedited UAA described above and are thus not included in Appendix E.

As described in Appendix E, both dissolved and total concentrations of metals in stormwater samples were typically higher in samples collected from stormwater samplers installed at higher elevations above the creek channel. This may be due to a longer contact time between runoff and COC-containing soil and sediment or may be due to greater entrainment of COC-containing sediments at higher flows. Concentrations of total metals were generally substantially higher than concentrations of dissolved metals because most samplers contained substantial quantities of sediment entrained within the samplers and the sample bottles at the time of sample retrieval and the presence of these sediments may have resulted in elevated concentrations of total metals in the stormwater samples. These sediments coupled with the uncertainty regarding the amount of time samples were in the sample bottles prior to retrieval introduced uncertainty in the quality of the data. Because of this, the data in Appendix E were evaluated qualitatively to guide the refinement of the conceptual site model.

4.1.2 Other Activities

Rangeland Improvements

Chino and their lessees periodically perform maintenance activities on the rangelands lying within site boundaries, including removing earthen stock tanks that are no longer required either because they are no longer used or because they are redundant due to other stock tanks located nearby. As part of these rangeland improvements, stock tanks 15, 26, 29, and 60 were removed between 2013 and 2022 and were not replaced.

Additionally, the approximately 230-acre drainage basin feeding stock tank 06 was improved in 2023 to provide for stable stormwater conveyance to the tank inlet. The drainage channel upgradient of the tank has been improved for approximately ½ mile, beginning at stock tank 06 and extending northeast to the railroad crossing immediately west of the intersection of North Hurley Road and A Street. During these improvements, material was identified along the railroad track that could act as a source of copper to the drainage feeding stock tank 06; this material was removed, and the area was regraded. In addition, five check dams were installed along the drainage to slow stormwater flows entering stock tank 06. These improvements will achieve their desired effect, and an improvement to water quality is also expected.

4.2 Nature and Extent of Contamination

All surface water data in the STSIU were compiled and compared to current New Mexico Water Quality Control Commission (NMWQCC) aquatic life criteria for the constituents identified as a concern in the 2008 RI (SRK 2008a,b) and ERA (Newfields 2008). The constituents of concern in the RI addendum included copper, cadmium, and lead after accounting for filtration at 0.45 and 0.001-micron size fraction to ensure dissolved concentrations were evaluated (SRK 2008b). Aluminum is compared to criteria based on total concentrations as required by current NMWQCC criteria and thus, even though aluminum is not known to be detected in historic smelter emissions, was included to be complete. Nickel and silver were mentioned as a possible concern for aquatic life in SRK (2008a) and thus were also included. Tables 4-1 to 4-3 (COCs other than copper) and 4-5 to 4-7 (copper results) present the results and comparisons to criteria (locations shown in Figure 4-3), expressed as hazard quotients (HQ) for ephemeral drainages, non-ephemeral drainages and stock tanks. The HQ is the observed concentration divided by the hardness-adjusted criteria concentration. Exceedances (HQ > 1) of chronic criteria for one or more locations occurred for aluminum, cadmium, copper, and lead for both ephemeral and non-ephemeral drainages. Aluminum, cadmium and copper exceeded acute criteria for ephemeral drainages, and only copper and aluminum exceeded acute criteria for non-ephemeral drainages. For stock tanks, aluminum, copper and lead exceeded chronic criteria and aluminum and copper exceeded acute criteria. Aluminum, however, is not sourced from historical emissions (SRK 2008b) and is not discussed further. Only acute criteria are applicable to (1) ephemeral drainages listed in Tables 4-1 and 4-5 and (2) stock tanks, which are fed by ephemeral drainages shown in Table 4-3 and 4-7 (see NMAC §20.6.4.808 – 809). Because the exceedances are insignificant when compared to those for copper, and that any measure taken to address copper in STSIU surface water would also address the exceedances of these metals, copper is the constituent of focus for STSIU surface water.

As described in Section 4.1, additional STSIU surface-water studies were completed after the RI Addendum report was accepted. These studies include the Wet Season Survey conducted in 2010 - 2013, the Criteria Adjustment Study conducted in 2011, and the Expedited UAA Study and Surface Water Runoff Quality and Duration Study conducted in 2011. Metal concentration data collected during these studies are included in this nature-and-extent section. Copper WERs calculated in accordance with NMAC §20.6.4.808/809[13] are also considered herein for evaluating the nature and extent of copper contamination. Based on hydrologic classifications shown in Figure 4-2, chronic aquatic life criteria are only considered for the non-ephemeral drainages; whereas, acute criteria are considered applicable to the ephemeral drainages.

4.2.1 Copper – Surface Water Drainages

Most ephemeral surface water drainage locations in the STSIU (Figure 4-2) exceed the standard hardness-adjusted NMWQCC acute aquatic life standards for copper (Table 4-5). Two WER methods were applied to adjust the criteria to more site-specific conditions: the watershed-specific WERs and the geometric mean for the STSIU WER (developed from data in Table 4-4). Acute criteria, not chronic criteria, apply to the ephemeral drainages listed in Table 4-5 (see NMAC §20.6.4.808 – 809; chronic hardness-adjusted criteria shown for completeness). Fewer ephemeral locations exceeded the site-specific WER-based acute criteria for copper than before applying the WER, and most had HQ < 2. Those with HQ > 1 comprised only one sample of many in subdrainages with exceedances, except Drainage D3. Drainage D3 had all acute criteria HQs up to 5 for the more site-specific Acute criteria WER-based HQs (Table 4-5). Ephemeral drainages B, D-1, G, and Lampbright Draw had HQs < 1, whereas Drainages A, C1, C2, D2, and D3 had at least one sample with HQ > 1. Drainages with HQ > 1 are depicted on Figure 4-3 using dashed lines. The WER-based Chronic HQs that were > 1 on non-ephemeral streams were uncommon, with only one sample (of 11) in Martin Canyon (but later years showed HQ in the same area was < 1 in Martin Canyon so not of concern), one sample (of 12) in Rustler Canyon (SW05-2007 in Table 4-6 had a very high HQ but should not be included because a slope failure caused the high copper temporarily at that location in 2007), one sample in headwaters of subwatershed C-1, and none in Lucky Bill Canyon exceeding

[13] Specifies criteria in NMAC §20.6.4.900 will be multiplied by a site-specific WER value calculated from the equation:

$$WER = \frac{10^{0.588+(0.0703\ x \log DOC)+(0.395\ x \log Alkalinity)\cdot\left(\frac{100}{Hardness}\right)^{0.9422}}}{19.31}$$, where DOC = dissolved organic carbon.

criteria (Table 4-6). The more general WER-based HQs (last column in Tables 4-5 and 4-6) generally give similar results for Tables 4-5 and 4-6.

Figure 4-3 shows the nature and extent of copper contamination in the drainages based on these WER results. Areas of no concern (solid lines) and potential concern (dashed lines) are shown based on HQs > 1, with ephemeral drainages depicted as yellow lines and non-ephemeral drainages as green lines.[14] Recognizing that aquatic habitat in STSIU surface-water drainages in bedrock sections of drainage channels consists mostly of isolated and distal pools (with the exception of Stock Tanks in these areas), Figure 4-3 also distinguishes the bedrock-dominated channels as bright yellow lines. The alluvium-dominated drainages are depicted with pale yellow lines. This depiction is intended to highlight drainage areas in which significant pool habitats do not occur due to substrate limitations in the alluvial habitat where habitat for biota is minimal. Pools in the alluvial, ephemeral habitat are rare. In summary, the solid green lines shown in Figure 4-3 represent non-ephemeral drainages in which copper contamination is not expected to be of concern based on compliance with the NMAC §20.6.4.809 based on the copper WER-based HQs (HQ $\leq$ 1) in Table 4-6. Similarly, the solid yellow lines represent drainages in which copper contamination is not expected to be of concern based on compliance with the NMAC §20.6.4.808 based on the copper WER-based HQs (HQ $\leq$ 1) in Table 4-5.

After the drainages of potential concern (HQ > 1) were initially identified (A, C1, C2, D2, D3, Martin and Rustler Canyon), drainages that should be carried forward in the FS for consideration for remediation were identified based on the most current conditions. If a drainage had HQ > 1 in 2006-2007 or earlier, and the exceedance was no longer present in the same general locations in future years (2010-2013), then the drainage was not considered for remediation as it already has achieved the pre-FS RAC. This was true for C1 ephemeral (downgradient of Bolton Canyon confluence), Martin Canyon, and Rustler Canyon. Therefore, Drainages A, non-ephemeral C1 upgradient of Bolton Canyon confluence, C2 (ephemeral only), D2, and D3 were carried forward for consideration for remediation.

4.2.2 Copper – Stock Tanks

Water chemistry has been evaluated for some of the STSIU stock tanks during previous Site investigations, including the STSIU ERA, STSIU RI, and Wet Season Survey, and from select stock tanks in 2021. The STSIU stock tanks consist of concrete or steel tanks that receive water from springs or windmill-pumped groundwater, and earthen tanks that receive the majority of their water from surface runoff. Earthen tanks in STSIU are typically located in surface water drainages and thus collect water from upgradient drainage channels during precipitation events. A few earthen tanks, however, are located outside of drainage channels and receive overland flow directly from adjacent upland areas instead of upgradient drainage channels. Figure 4-4 shows the current and historical locations and type of known STSIU stock tanks and distinguishes individual tanks of potential concern based on the WERs, as described below.

All sampled stock tanks are on ephemeral drainages, and while they generally recharge during the monsoon season, they dry up by the end of the year. Therefore, STSIU-specific NMAC §20.6.4.809 is used herein to evaluate the nature and extent of copper contamination in stock tanks. As indicated in Figure 4-4, earthen stock tanks are the major focus of this evaluation because these tanks receive their water from surface runoff, which can potentially be contaminated by upland COC sources (in contrast to steel and concrete tanks that receive groundwater via springs or windmill pumps). Surface water chemistry data are available for 11 earthen stock

[14] Lucky Bill Canyon was designated as ephemeral in southern drainage and non-ephemeral in northern drainage based on observations.

tanks, which includes the majority of earthen stock tanks located in the general area of potential concern based on proximity to the historic smelter location (i.e., within subwatersheds A through E) (Figure 4-4; Table 4-7). WERs determined in drainage pools for each subwatershed were used for the stock tanks in the corresponding watershed. These WERs are expected to represent conservative estimates of potential WERs for stock tanks because organic carbon, which greatly mitigates copper toxicity, is generally greater in stock tanks than in surface water pools (due to additional organic matter input from livestock use and aquatic vegetation).

Application of the standard NMAC §20.6.4.900 for the stock tanks results in exceedances of the standard hardness-adjusted copper criteria with the greatest hardness-adjusted acute HQ equal to 29 in the subwatershed E (west drainage, Figure 4-3) stock tank 6; Table 4-7).[15] Adjusted copper HQs were calculated for each stock tank following the STSIU-specific NMAC §20.6.4.809 using two WER methods: the watershed-specific WERs and the geometric mean STSIU WER (Table 4-4). For stock tanks that were sampled multiple times throughout previous investigations, geometric mean adjusted copper HQs were also calculated to provide a more robust estimate of tanks of potential concern. Using the above WER methodology and evaluating the geometric means when available, stock tanks 6, 15, 29, 60, and West Drainage were determined to have concentrations of potential concern to aquatic life with HQ > 1 (Table 4-7). However, stock tanks 15, 26, 29, and 60 were removed between 2013 and 2022 as part of rangeland improvements, as discussed in Section 4.1.2, and are not considered further, leaving only stock tank 6 in the west drainage of concern.

4.3 Surface Water Locations to be Evaluated for Remedial Alternatives

Drainages

Surface water locations described above as areas of potential concern to aquatic life uses were evaluated for remedial alternatives. Drainages A, C1, C2, D2 and D3 are carried forward..

Stock Tanks

Stock tank 6 was determined to have concentrations of potential concern to aquatic life uses and will be evaluated for remedial technologies.

[15] This stock tank 06 was sampled in 2004 and 2006 for the STSIU RI to represent E2 drainage in subwatershed E, with HQs of 1 and 6, respectively (Table 4-7). Usually no water is found in the rest of this ephemeral drainage and because sampling was always in the stock tank location where water was found, E drainage is not included in Table 4-5.

5. Identification and Screening of Potentially Applicable Technologies

5.1 Soil

As part of the FS Proposal, a range of potential soil remedial technologies have been identified and summarized for the upland areas of the STSIU. In 2006, an extensive literature search was conducted consisting of a review of over 500 abstracts related to potential soil remedial technologies for treatment and/or removal of the primary COC for the site (copper). As a result of this review, 12 technologies were identified and included in this FS as Table 5-1 for a preliminary screening and evaluation. The preliminary screening and evaluation of the potential soil remedial technologies has been performed to determine which remedial technologies should be retained for consideration as part of the FS alternatives analysis, which will include a comprehensive alternatives evaluation for remedial alternatives for the site. The preliminary screening of each remedial technology is based on USEPA Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (USEPA 1988) and includes an evaluation of the effectiveness, implementability, and cost. Potential use of institutional controls consistent with CERCLA guidance (USEPA 2012) may be warranted for implementation of specific remedial technologies as described below.

Based on the preliminary screening conducted in the FS Proposal, only a brief summary of the technology is presented, with a summary of the effectiveness, implementability and cost presented in Table 5-1. If the remedial technology is considered viable, it will be retained for consideration as part of the site-wide remedial alternatives analysis in Section 6.

A brief explanation of these soil remedial technologies described below and a preliminary screening of each technology in presented in Table 5-1.

5.1.1 No Action

This remedial technology consists of leaving the site soils in their current condition without performing any soils/vegetation removal or treatment, engineering controls, or institutional controls as part of the remediation efforts. This technology is provided as a baseline for screening other technologies and is summarized as Technology No. 1 in Table 5-1.

Screening Result

No Action is being retained as a baseline for comparison with other remedial technologies in the FS and for potential use in conjunction with other technologies where implementability may be low.

5.1.2 Monitoring

This remedial technology consists of leaving the site soils in their current condition without performing any soils/vegetation removal or treatment, engineering controls, or institutional controls as part of the remediation efforts. As part of this technology, a monitoring program would be implemented to observe and document the occurrence of natural attenuation of site contaminants. Natural attenuation may occur due to (1) cessation of processes that contributed to copper deposition in soil and (2) continuation of natural processes that deposit clean dust/soil, rain, and litter on the soils. The cessation of operation of the smelter in 2007 reduced copper deposition in the soils, and reclamation of many of the tailing ponds has reduced windblown deposition in the non-operational areas. Natural processes that deposit clean dust/soil or reduce its toxicity include wind deposition, periodic regular alkaline rains that reduce copper bioavailability over time (increase pH and pCu), unusual white rain events (windstorms picking up lime from playas and depositing them on the site which increases pH), and soil erosion from uplands into drainages. Rainfall also can cause leaching of copper into deeper soils, reducing exposure at the surface to ecological and human receptors. Monitoring is designed to detect if these processes are occurring, reducing the copper concentrations and increasing pH (and thus pCu) over time. The rate of attenuation cannot currently be estimated due to limited number of years with data in the same location and variability in the data.

Monitoring would include collection of qualitative and quantitative samples of STSIU media such as surface soils, vegetation and other biotic media. This technology is provided as a baseline for screening other technologies and is summarized as Technology No. 2 in Table 5-1.

Screening Result

Monitoring is being retained as a baseline for comparison with other remedial technologies in the FS and for potential use in conjunction with other technologies where implementability may be low.

5.1.3 Excavation and Reuse

This remedial technology consists of removal of soils with contaminants above the soil pre-FS RAC levels located 0- to 1-inches to 6-inches bgs, depending on the potential receptor. Depth of potential removal could vary depending on site features such as the presence of bedrock. Final lateral and vertical removal extents would be determined during the remedial design. This technology would remove soils considered to be impacted for final onsite management at the waste rock stockpiles or for future use as soil fill material for the Chino Mine tailings pond closure activities or other operational areas of the site. The soils would be ripped if needed (or filled with clean soil) to improve their texture for plant growth and areas seeded to meet CCP guidelines. This technology is summarized as Technology No. 3 in Table 5-1.

Screening Result

Soil excavation could be applied at the site for the overall site-wide remedy or applied at targeted locations with higher concentrations of contaminated soils in conjunction with another technology. Although this technology may not be implementable at all areas, this technology is being retained due to its high effectiveness at reducing site contaminants.

5.1.4 Excavation and Disposal

This remedial technology consists of removing soils above the soil RAC levels in the same manner as described in the excavation and onsite management remedial technology described in Section 5.1.3. However, instead of final onsite management of soils at the waste rock stockpiles or re-using the removed soils for fill material in the operational areas of the site, the soils would be disposed of at an offsite commercial disposal facility.

Removed soils would be characterized in accordance with Resource Conservation Recovery Act regulations to determine final offsite transportation and disposition requirements. This technology is summarized as Technology No. 3a in Table 5-1.

Screening Result

Soil excavation could be applied at the Site for the overall site-wide remedy or applied at targeted locations with higher concentrations of contaminated soils in conjunction with another technology. This technology would only be implemented on a limited or case-by-case basis, in select areas. Although this technology may not be implementable at all areas, this technology is being retained due to its high effectiveness at reducing site contaminants.

5.1.5 Soil Amendments – Limestone and/or Organic Matter

Many soil amendment technologies exist for reducing metals bioavailability, toxicity, and mobility in soils. They rely on changing soil chemistry to affect the solubility or mobility of site contaminants within the soil column, and/or improve vegetative cover or speciation. Several soil amendments are described further below including, pH adjustment via lime addition and/or organic matter, tilling (Section 5.1.6), ferrihydrite (Section 5.1.7) and chelating agents (Section 5.1.8). The pH adjustment and/or organic matter addition technology is summarized as Technology No. 4a in Table 5-1. As included in the Amendment Study Work Plan (Arcadis 2008a), data collected over the five years of monitoring was assessed to determine if a particular amendment, or combination thereof, can be successfully applied to particular areas at the Site.

The analysis in Arcadis (2017) in Appendix A indicates that liming is recommended for soils with pH < 2 but liming is not that helpful above that pH, and soils pH identified herein are not less than pH 2. Organic matter was not recommended after the amendment study was completed because cow manure brought in weedy plants that degraded the habitat (however, other forms of organic matter could be considered). Use of organic matter was screened out in this FS because other amendments were more effective (Appendix A).

Screening Result

Soil amendment using lime will be retained as a remedial technology to be considered as part of the comprehensive remedial alternative for further evaluation in the FS.

5.1.6 Soil Amendments – Tilling

Soil mixing by using mechanical tilling or ripping technology is being evaluated as part of this FS for use at the site as part of the comprehensive remedial alternative. This technology does not include the addition of other amendments such as lime and/or organic matter or include seeding; however, some of the subsurface soils at STSIU may include Gila Conglomerate Formation or other geological formations which have high alkalinity and geochemistry that may serve as a naturally-occurring amendment from wind-borne and erosional deposition. Tilling would be conducted in a similar manner as performed in the soil amendment study. Initially, the ground surface vegetation is cleared and grubbed using a bulldozer and/or excavator. Following vegetation clearing, the tilling is conducted using a 140 blade (or similar) attached to a bulldozer to mix to a pre-determined depth of soil. In areas requiring soil mixing with limited access to larger equipment, hand tilling equipment can be used as an alternative to the bulldozer to mix soils. Tilling is less intrusive in general than excavation; it lowers disruption to habitat and lowers carbon footprint compared to alternatives relying on excavation.

Tilling, which mixes higher concentration surface soils with deeper soils, has the potential to provide additional reduction of metal concentrations and to raise pH conditions to more neutral pH conditions pending existing pH levels within the soil treatment area being tilled. Plant coverage, pH, and soil chemistry would be monitored post-tilling operations. As part of the remedial design phase, additional soil sampling (contaminant levels and soil chemistry) within the soil treatment column would be conducted to determine if tilling alone would be appropriate technology and what is the appropriate soil mixing depth within each soil treatment area to raise pH conditions. The soil amendments - tilling technology is summarized as Technology No. 4b in Table 5-1.

Screening Result

Tilling is being retained for comparison with other remedial technologies in the FS and for potential use in conjunction with other technologies where implementability may be low. Tilling could potentially be applied at the majority of the site areas containing sufficient equipment access and appropriate terrain slopes or at targeted locations (e.g. in areas where lime and organic matter soil amendments are not applied, if applicable).

5.1.7 Soil Amendments – Ferrihydrite

The use of the soil amendment ferrihydrite as a potential soil remedial technology is being evaluated for use at STSIU as part of a comprehensive remedial alternative. The addition of ferrihydrite to soils containing copper has been observed to bind copper, reduce free Cu^{2+} activity, and total soluble and labile concentrations of copper. The soil amendments - ferrihydrite technology is summarized as Technology No. 4c in Table 5-1.

Screening Result

A site-specific data gap for this particular technology currently exists. And if this technology were to be considered a pilot and/or bench-scale treatability study would be proposed. While pilot and/or bench scale treatability studies are not being proposed to be conducted at this time, this technology is being retained as a remedial technology to be considered as part of the comprehensive remedial alternative for further evaluation in the FS.

5.1.8 Soil Amendments – Chelating Agents

The application of chelating agents as a potential soil remedial technology is being evaluated for use at STSIU as part of a comprehensive remedial alternative. Specifically, chelating agents are being evaluated for use in the following soil remedial technologies:

- Phytoextraction;
- Soil Washing (Ex-Situ); and
- Soil Washing (In-Situ).

Chelating agents are compounds that are added to the soil to either assist in increasing the uptake of the contaminant (i.e., copper) into plants for the phytoextraction process or for removing a metal from soils as part of a soil washing technique. The use of chelating agents in the phytoextraction and soil washing processes are discussed in detail below and are summarized as Technologies Nos. 4d1, 4d2, and 4d3 in Table 5-1.

5.1.8.1 Soil Washing (Ex-Situ)

Ex-situ soil washing is a soil remedial technique consisting of removing and concentrating contaminants from bulk soil using separation methodologies. Soil washing can be applied to soils containing heavy metals. The resulting concentrated soil containing the contaminants must be characterized for further treatment and/or offsite disposition. The “clean” portion of the separated soil is also characterized to determine if it meets the criteria for on-site reuse to be returned to the excavations or if it requires further treatment and/or offsite disposition.

The design of the soil washing process, including the size of scrubber unit, type of soil washing detergent, and soil handling requirements, would be determined via a pilot treatability study and during the remedial design.

Screening Result

Although the cost of soil washing may be moderately lower than excavation, the uncertainty of this technology and the access limitations of water and equipment to certain areas of the STSIU does not make it a viable remedial technology. Soil washing is not being retained as a remedial technology for consideration as part of the comprehensive remedial alternative for further evaluation in the FS.

5.1.8.2 Soil Washing (In-Situ)

In-situ soil washing consists of introducing a chelating agent into the soil. The chelating agent assists in mobilizing the contaminant within the soil column and allows it to become more soluble in the groundwater. The groundwater, containing the site contaminant, is then extracted with a groundwater extraction system for treatment and/or disposal.

Screening Result

Due to the lack of infrastructure required for the groundwater extraction system, the high costs, and the uncertainty in the effectiveness, in-situ soil washing is not considered a viable remedial technology. In addition, site accessibility issues, including the remoteness of the site and incongruous nature of areas needing treatment, will make soil washing less implementable or potentially infeasible for certain portions of STSIU. Therefore, in-situ soil washing is not being retained as a remedial technology for consideration as part of the comprehensive remedial alternative for further evaluation in the FS.

5.1.8.3 Phytoextraction

Phytoextraction is the process of plants taking up contaminants (i.e., copper) located in the soils via the plant root system. Once the metals have been transferred through the root system, the contaminants are subsequently transferred and accumulated into the aboveground portions of the plant tissue. Once the phytoaccumulation (contaminants transferred to the above ground plant tissue) has occurred, the contaminants are removed from the site by harvesting the plants. An additional phytoextraction technology consists of the contaminant accumulation occurring just in the root system, resulting in the need to harvest the entire plant (including the roots) to remove the contaminants from the site. The plant species selected for phytoextraction must be able to tolerate the site contamination (i.e., copper), must be fast growing, have a high biomass, and easily be harvested.

Screening Result

Although phytoextraction costs significantly less during the initial phase of treatment and is less invasive as compared to other soil remedial technologies, the uncertainty of this technology being effective in the natural environment, the potential of SGFBs consuming impacted vegetation and seeds, and the significantly increased treatment duration, does not make it a viable option. Phytoextraction is not being retained as a remedial technology for consideration as part of the comprehensive remedial alternative for further evaluation in the FS.

5.1.9 Containment – Soil Cover

The use of a soil cover is being considered as a potential remedial technology at the site to contain the impacted soils and prevent exposure of site contaminants to potential site receptors. As part of this remedial technology, a soil cover would be placed over existing soils with site contaminant levels above the Pre-FS RAC values. In addition, areas of the site that currently consist of soils intermixed with exposed bedrock but have been determined to historically contain fully established soil and vegetative covers would be considered for a soil cover.

The purpose of the soil cover is to place imported, approved soils upon impacted soils or exposed bedrock areas to provide a layer of clean soil that would provide protection of SGFBs and would promote growth of local, naturally occurring vegetation. Clean, approved soil cover material would be spread, graded, and compacted to promote positive drainage. The minimum thickness and type of soil, including percentage of organic matter, to be used for the soil cover would be selected during the remedial design. The containment – soil cover technology is summarized as Technology No. 5a in Table 5-1.

Screening Result

Installation of a soil cover is considered to be a viable, cost-effective, and easily implementable remedial technology and will be retained as a remedial technology to be considered a part of the comprehensive remedial alternative for further evaluation in the FS.

5.1.10 Containment – Impermeable Cover

This remedial technology consists of placing an impermeable cover over targeted areas with soil contaminant levels above the pre-FS RAC. This technology would include preparing the ground surface and site grades to accommodate the installation of the impermeable cover layer. Ground surface preparation activities would include clearing and grubbing existing vegetation and smoothing and compaction of the ground surface using general construction equipment such as excavators, graders, and rollers. Once proper ground surface conditions have been met (i.e., site grade and subgrade compaction), the impermeable cover would be installed. Details of the impermeable cover, including subgrade preparation requirements, subbase layers, and final impermeable cover material and thickness would be determined during the remedial design. The containment – impermeable cover technology is summarized as Technology No. 5b in Table 5-1.

Screening Result

Because it is not practical to implement this technology on a large scale and due to the impacts of surface water infiltration and stormwater run-off, and limitations on future vegetated growth and grazing, an impermeable cover is not considered a viable remedial technology to be retained for further evaluation in the FS.

5.1.11 Surface Soil Controls – Phytostabilization

The purpose of surface soil controls is to further stabilize the surface soils to prevent or greatly reduce airborne dispersion of soils and provide overall erosion control for storm water. Phytostabilization is considered a remedial technology that would provide increased surface soil controls. Phytostabilization consists of vegetating the ground surface with plant species that are targeted at increasing long term soil stabilization as compared to existing vegetative conditions and/or other revegetation options that are not focused specifically on soil stabilization. The seed and plant species, planting locations and density, thinning requirements, and operation and maintenance (O&M) activities would be determined during the remedial design. The surface soil controls - phytostabilization technology is summarized as Technology No. 6 in Table 5-1.

Screening Result

Phytostabilization may be challenging because plant species must be tolerant to low pCu soils but shrubs with deep roots could grow. This will be retained as a remedial technology to be considered as part of the comprehensive remedial alternative for evaluation in in the FS.

5.1.12 Phytoremediation

Phytoremediation consists of planting vegetation (trees and/or plants) that can uptake the contaminants located in the soil and subsequently remediate the soils. Trees and/or plants remove the site contaminants when the roots take in water and nutrients from the surrounding impacted soils. Metals are stored in the roots, stems, or leaves of the vegetation, effectively removing them from the soil. Activities that are associated with the implementation of phytoremediation include selection of the proper tree and plant species, site preparation (potentially clearing and grubbing existing vegetation), planting, and O&M to ensure that the trees and plants are being established. The phytoremediation technology is summarized as Technology No. 7 in Table 5-1.

Screening Result

Due to the extended time period it would initially take to reduce site contaminants from the soils and the fact that the site remedy effectiveness is directly dependent on the success of the trees and plants that can grow in low pCu soils, phytoremediation is not being retained for further evaluation in the FS.

5.1.13 Electrokinetic Remediation

Electrokinetic remediation is being evaluated as part of this FS for use at the site as part of the comprehensive remedial alternative. Electrokinetics is based on the principle that when direct current (DC) is passed through contaminated soil, certain (negatively charged) types of contaminants will migrate through the soil pore water to a place where they can be removed. This alternative uses electrode assemblies that are installed in the ground in a square array and connected to a DC voltage power supply. When the DC power supply is activated, a current passes through the soil. As the electric current is applied to the soil between the electrodes, water flows by electroosmosis in the soil pores usually toward the cathode. When the contaminated water reaches the cathode, it is pumped to the surface by circulating water within the ceramic casing.

Electrokinetic remediation has the potential to provide remediation of copper contamination without physically removing any soil. The lack of physical soil removal allows for remediation without impacting the surface vegetation at the cost of increasing acidity in the surface soil. This increase in acidity would compound the already low overall pH in Chino soils east of the historic smelter. The electrokinetic technology is summarized as Technology No. 8 in Table 5-1.

Screening Result

It is assumed that it is not practical to implement this remedial technology over large-scale area, and therefore this technology will not be retained for further evaluation in the FS Report. Even on a small scale, the potential decreased soil pH and difficulties implementing this alternative in areas with low soil moisture are considered significant enough that this alternative will not be retained for evaluation in the FS.

5.1.14 Summary and Identification of Data Needs

The following soil remedial technologies were evaluated in the preliminary screen:

- No Action [retained];
- Monitoring [retained];
- Excavation and Reuse [retained];

- Excavation and Disposal [retained];
- Soil Amendments – Lime and/or Organic Matter [retained];
- Soil Amendments – Tilling [retained];
- Soil Amendments – Chelating Agents [not retained];
- Soil Amendments – Ferrihydrite [retained];
- Containment – Soil Cover [retained];
- Containment – Impermeable Cover [not retained];
- Surface Soil Controls – Phytostabilization [retained];
- Phytoremediation [not retained]; and
- Electrokinetic Remediation [not retained].

There are no additional data needs that need to be considered based on this preliminary screen of remedial alternatives for soil.

5.2 Surface Water

As part of the FS Proposal, a range of potential surface water remedial technologies have been identified and summarized for the drainage areas and stock tank associated with the Site. A preliminary screening and evaluation of the potential surface water remedial technologies has been performed to determine which remedial technologies should be retained for consideration as part of the FS, which will include a comprehensive alternatives evaluation for the site. The preliminary screening of each remedial technology is based on USEPA (1988) and includes an evaluation of the effectiveness, implementability, and cost.

Based on the preliminary screening, if the remedial technology is considered viable, it will be retained for consideration as part of the site-wide remedial alternatives analysis. As a result of this review, seven technologies were identified and are described in detail below and a preliminary screening of each technology in presented in Table 5-2.

5.2.1 No Action

This remedial technology consists of leaving the drainage areas which are known to contain surface water with levels of site contaminants above surface water Pre-FS RAC values, in their current condition without performing any soil, sediment, vegetation, groundwater and/or surface water removal or treatment. This technology is being retained to serve as a baseline control to compare to other potential surface water remedial technologies. This technology is summarized as Technology No. 1 in Table 5-2.

Screening Result

No Action is being retained as a baseline control for comparison with other remedial technologies in the FS and for potential use in conjunction with other technologies where implementability may be low.

5.2.2 Monitoring

This remedial technology consists of leaving the drainage areas which are known to contain surface water with levels of site contaminants above surface water Pre-FS RAC values, in their current condition without performing any soil, sediment, vegetation, groundwater and/or surface water removal or treatment. As part of this technology, a monitoring program would be implemented to observe and document the occurrence of natural attenuation of site contaminants, as described in Section 5.1.2, above. Monitoring would include collection of qualitative and quantitative samples of site media such as surface water, in-drainage sediments, and/or vegetation. This technology is being retained to serve as a baseline control to compare to other potential surface water remedial technologies. This technology is summarized as Technology No. 2 in Table 5-2.

Screening Result

Monitoring is being retained as a baseline control for comparison with other remedial technologies in the FS and for potential use in conjunction with other technologies where implementability may be low.

5.2.3 Excavation

This remedial technology consists of the removal of soils and/or sediments from the specified drainage areas. Based on the work presented in Appendix E, historical sediments and soils within the drainages may be contributing to surface water quality issues. Although a specific loading rate has not been determined for historical sediments for each drainage, sediments have been identified as a potential source to surface water. Therefore, excavation will be considered a viable remedial technology to consider for the comprehensive remedial alternative. This technology is summarized as Technology No. 3 in Table 5-2.

Screening Results

Excavation of sediments is an effective and technically implementable way of removing contaminated sediments from surface water although the costs associated with the excavation of sediments are considered to be high. Therefore, excavation of sediments is being retained for further evaluation as part of a comprehensive remedial alternative in the FS.

5.2.4 In-Stream Removal of Suspended Sediments

This remedial technology consists of in-stream removal of suspended sediments via construction of settling basins within the stream drainage area pathway. The contaminants are adhered to the suspended sediments located within the surface water, subsequently contributing to the exceedances of the surface water Pre-FS RAC values. Removal of the suspended sediments containing the contaminants will result in lowering the total contaminant concentrations in the surface water. There may still be a potential for dissolution of contaminants from sediments into the dissolved phase.

Multiple settling basins would be constructed at specified locations along the drainage area to capture sediments at different points along the surface water drainage pathway. The location, size, and materials of the settling basins would be determined during the remedial design. The settling basins would be located in areas that are easily accessible by construction equipment for removal of the accumulated sediments. The frequency of sediment removal from the settling pools will depend on the rate of sediment accumulation and would be determined during the remedial design. This technology is summarized as Technology No. 4 in Table 5-2.

Screening Results

In-stream removal of sediments seems to be an effective, technically implementable, and cost-effective way of removing contaminated sediments from surface water. Therefore, in-stream removal of sediments is being retained for further evaluation as part of a comprehensive remedial alternative in the FS.

5.2.5 Limestone Treatment

This ex-situ remedial technology consists of the installation of limestone features within the surface water drainage area to passively treat surface water with contaminant levels above the Pre-FS RAC levels. Contaminants which either adhere to the suspended sediments in surface water or are within the dissolved phase contribute to lowering the pH of the water which creates a more acidic environment when compared to naturally occurring surface water in the region that do not contain the contaminants.

Limestone features would require installation at multiple locations along the surface water drainage areas. The multiple locations of the limestone features would provide increased treatment of the surface water as it progresses down the drainage area. The limestone features installation may consist of the construction of a waterfall using limestone masses to increase surface water contact of the water with the limestone. In addition, limestone may be installed as armoring and/or chips. The final design and location of the limestone features would be determined during the remedial design. This technology is summarized as Technology No. 5 in Table 5-2.

Screening Results

Limestone treatment is an effective and technically implementable way of removing contaminated sediments from the surface water. Therefore, installation of limestone features is being retained for further evaluation as part of a comprehensive remedial alternative in the FS.

5.2.6 Alkaline Washing

This in-situ remedial technology consists of the insertion of an alkaline fluid into the active channel and bar sediments in the drainages of the STSIU to treat surface water with contaminant levels above the Pre-FS RAC levels.

In-situ treatment would need to be evaluated using a pilot study to determine the effectiveness of this technology on the STSIU sediments. This technology would only be an effective remedial technology if the majority of metals loading for the STSIU drainages are related to constituents in legacy sediments. If in-situ treatment is determined to be an effective remedial technology, however, this technology would require extensive infrastructure installation along the drainages for transport and treatment of an alkaline fluid. The final design and location of this infrastructure would be determined during the remedial design. This technology is summarized as Technology No. 6 in Table 5-2.

Screening Results

In-situ treatment may be effective and technically implementable way of neutralizing contaminated sediments prior to leaching to surface water, but due to the low implementability and high cost, this technology is not being retained for further evaluation as part of a comprehensive remedial alternative in the FS.

5.2.7 Sediment and Erosion Control

Based on the surface water quality data, presented in Section 4, stormwater run-off originating from the upland areas of the site is likely a contributing factor to surface water impacts within the drainage areas. A comprehensive sediment and erosion control system could be constructed to minimize impacts from entering the drainage areas. The sediment and erosion control system would be considered a permanent remedial technology that would reduce contaminants from entering the surface water located within the drainage area systems.

The sediment and erosion control system would consist of adjusting surrounding grade elevations where necessary and installing various types of Best Management Practices (BMPs) to redirect upland run-off away from the surface water drainage areas and allow it to infiltrate directly into the upland soils. Grading adjustments may include, but may not be limited to, construction of swales, drainage ditches, and/or catch ponds to capture stormwater run-off for infiltration and/or redirect stormwater run-off from entering the drainage areas.

Temporary and permanent BMPs may be utilized as part of the sediment and erosion control system. Temporary BMPs may include silt fences, straw bales, and/or erosion control mats to be installed during construction and be maintained for a limited time after construction until vegetation has sufficiently been established. Permanent BMPs may include placement of gravel, stone, and/or riprap to be placed on newly graded areas, as warranted. The erosion and control system, including grading adjustments and BMP details would be determined during the remedial design. This technology is summarized as Technology No. 7 in Table 5-2.

Screening Results

Construction of sediment and erosion control systems near the drainage areas are considered to be effective, technically implementable, and cost effective. Therefore, installation of sediment and erosion control systems is being retained for further evaluation as part of a comprehensive remedial alternative in the FS.

5.2.8 Summary and Identification of Data Needs

The following surface water remedial technologies were evaluated in the preliminary screen:

- No Action [retained];
- Monitoring [retained];
- Excavation [retained];
- In-stream Removal of Suspended Sediments [retained];
- Limestone Treatment [retained];
- Alkaline Washing [not retained]; and
- Sediment and Erosion Control [retained].

Besides ongoing sampling activities, there are no additional data needs that need to be considered based on this preliminary screen of remedial alternatives for surface water.

A summary of retained remedial technologies is included in Table 5-3.

6. Assembly and Development of Remediation Alternatives

In this Section, remediation technologies retained after screening in Section 5 are assembled into remediation alternatives to identify one or more options that will address the remedial action objectives. A list of the remediation technologies and alternatives are presented in Tables 6-1 through 6-4. A more detailed description of the technologies is presented in Section 5.

6.1 Soils Alternatives – Total Metals

Five alternatives have been developed to consider for remediation of the soils for total metals within the STSIU. The regulatory standards for human health and ecological risk are different. Human health standards are 5,000 mg/kg of copper and 100,000 mg/kg for iron. Avian risk is based on 95UCL area-weighted average concentration within an exposure unit with concentrations greater than 1,600 mg/kg. Concentrations greater than 1,100 mg/kg requiring monitoring. The technologies of the alternatives are listed in Table 6-1.

Alternative 1: No Action

- Alternative 2: Monitoring
- Alternative 3: Excavation and Monitoring
- Alternative 4: Soil Cover and Monitoring
- Alternative 5: Soil Amendments/Tilling and Monitoring

6.1.1 Alternative 1: No Action

A no action alternative is included as a baseline comparison to the other remedial alternatives. This alternative would leave the site for upland soil for arsenic, lead and copper in its current state.

6.1.2 Alternative 2: Monitoring

In this alternative upland soils would be monitored for potential natural attenuation of copper concentrations in areas that fail the human health or ecological Pre-FS RAC including 95UCL area-weighted average copper concentrations within exposure units with concentrations between 1,100 and 1,600 mg/kg of copper would be conducted for avian risk. NMED (2011b) indicates:

> *Chino shall propose risk-based monitoring of abiotic and/or biotic media to help ensure that risk from copper exposure of small ground-feeding birds in the exposure unit do not exceed acceptable levels. A protectiveness assessment consistent with CERCLA guidance will be conducted on a population basis…This monitoring shall include, at a minimum, ground-dwelling invertebrates, an indicator of copper exposure to birds that feed primarily on invertebrates during critical life stage. This requirement is intended to offset uncertainties in estimated copper exposure between 1,100 and 1,600 mg/kg. Monitoring shall be conducted in intervals no greater than 2 years for the first 5 years to establish a trend within the first 5 year review period. Monitoring frequency beyond the first years will be determined based on the first 5 year review recommendations.*

Monitoring would be completed once NMED issues the ROD.

6.1.3 Alternative 3: Excavation and Monitoring

In this alternative, excavation is a technology that can reduce soil copper concentrations greater than 5,000 mg/kg for human health and 1,600 mg/kg for avian risk. As discussed under Alternative 2, monitoring of 95UCL area-weighted average concentration within an exposure unit with concentrations between 1,100 and 1,600 mg/kg of copper would be conducted for avian risk.

Excavated soil, greater than the RAOs, would be taken to the operational area for subsequent reuse.

6.1.4 Alternative 4: Soil Cover and Monitoring

This alternative is a combination of soil cover long-term maintenance and monitoring. It would be implemented for the same area as Alternative 3, by covering all areas needing protection for human health (> 5,000 mg/kg copper) and avian risk (> 1,600 mg/kg copper). This alternative would include the placement of a clean cover (minimum 6-inches of soil) over the exposure areas and revegetation. Long-term maintenance and monitoring of the cover would be required, and institutional controls would be required.

6.1.5 Alternative 5: Soil Amendments/Tilling and Monitoring

This alternative is a combination of soil amendments, with potentially tilling, implemented for the same areas as Alternative 3 and 4. This alternative would implement soil amendments based on the results of the soil amendment study, which was completed in 2013.The study does not recommend manure amendments, but recommends lime amendments in areas with very low pH. Therefore, this alternative includes a combination of tilling and soil amendments.

6.2 Soils Alternatives – Cupric Ion Activity

Six alternatives have been developed to consider for remediation of the soils for pCu within the STSIU. The areas being considered for remedial alternatives are the areas presented in Figure 3-13 that have pCu concentrations less than a predefined PEL, where copper concentrations are greater than 327 mg/kg, and also meet the evaluation criteria described in Section 3.2.4. There is some overlap between the areas discussed in Section 6.1 (total metals) and Section 6.2 (pCu). The selection of a remedy for each remedial component may have an impact on the other. This interaction will be described in Section 7. The technologies of the alternatives are listed in Table 6-2.

- Alternative 1: No Action
- Alternative 2: Monitoring
- Alternative 3: Excavation (Reuse or Disposal) and Monitoring
- Alternative 4: Soil Amendments (Lime), Tilling and Monitoring
- Alternative 5: Tilling and Monitoring
- Alternative 6: Soil Amendments (Ferrihydrite), Tilling and Monitoring

- Alternative 7: Soil Cover and Monitoring
- Alternative 8: Surface Soil Controls – Phytostabilization

6.2.1 Alternative 1: No Action

A no action alternative is included as a baseline comparison to the other remedial alternatives. This alternative would leave the site for upland soil for pCu in its current state.

6.2.2 Alternative 2: Monitoring

In this alternative, upland soils for pCu would be monitored for potential natural attenuation of copper concentrations in areas that have a pCu less than 5.0, where copper concentrations are greater than 327 mg/kg.

6.2.3 Alternative 3: Excavation (Reuse or Disposal) and Monitoring

In this alternative, to the extent possible, low pCu areas would be excavated until the pCu of the top six inches of soil meet the criteria of greater than 5.0 or copper drops below 327 mg/kg. Excavated soil, less than the pCu RAO, would either be taken to the operational area for subsequent reuse or taken to the West Stockpile for recycling (disposal option). Excavation of low pCu soils would be limited because of the infeasibility of excavating in areas of bedrock and steep slopes. Monitoring of the areas would be conducted to determine if the pCu values are stable over time.

6.2.4 Alternative 4: Soil Amendments (Lime), Tilling and Monitoring

Based on the results of the soil amendment study plots (Appendix A) and white rain studies (Appendix B), lime could be added to areas where pCu is less than 5.0 or to low pH areas (pH < 2). This alternative is Alternative 5 with the addition of amendments, which can be in low pCu areas or in areas where soils cannot be tilled (e.g., too shallow or steep slopes). This alternative may be appropriate as it provides additionally for amendments in areas where tilling is not feasible. Some areas may still be inaccessible, even on foot, for application of amendments. Monitoring of the areas would be conducted to determine if the pCu values are stable over time.

6.2.5 Alternative 5: Tilling and Monitoring

In this alternative, to the extent possible, low pCu areas would be tilled using mechanical means. No soil amendments or addition of organic material would be included in this alternative, based on the amendment study (Appendix A) finding that tilling alone can be very effective. Tilling would not be conducted on areas inaccessible to the mechanical equipment, or on bedrock outcrops. Monitoring of the areas would be conducted to determine if the pCu values are stable over time.

6.2.6 Alternative 6: Soil Amendments (Ferrihydrite), Tilling, and Monitoring

In this alternative, ferrihydrite would be added to areas where pCu is less than 5.0. This alternative is Alternative 5 with the addition of amendments in areas where soils cannot be tilled (e.g., too shallow or steep slopes). This alternative may be appropriate as it provides additionally for amendments in areas where tilling is not feasible.

However, some areas may still be inaccessible, even on foot, for application of amendments. Monitoring of the areas would be conducted to determine if the pCu values are stable over time.

6.2.7 Alternative 7: Soil Cover and Monitoring

In this alternative, a soil cover would be placed over existing soils with site contaminant levels above the Pre-FS RAC values. In addition, areas of the site that currently consist of soils intermixed with exposed bedrock but have been determined to historically contain fully established soil and vegetative cover will be considered for a soil cover. The purpose of the soil cover is to place imported, approved soils upon impacted soils or exposed bedrock areas to provide a layer of clean soil that would provide protection of SGFBs and would promote growth of local, naturally occurring vegetation. Clean, approved soil cover material would be spread, graded, and compacted to promote positive drainage. The minimum thickness and type of soil, including percentage of organic matter, to be used for the soil cover would be selected during the remedial design. Monitoring of the cover would be conducted to verify the integrity of the remedy and to determine if the pCu values are stable over time.

6.2.8 Alternative 8: Surface Soil Controls – Phytostabilization

In this alternative, surface soil would be stabilized with vegetation to prevent or greatly reduce airborne dispersion of soils and provide overall erosion control for storm water. Phytostabilization consists of vegetating the ground surface with plant species that are targeted at increasing long term soil stabilization as compared to existing vegetative conditions and/or other revegetation options that are not focused specifically on soil stabilization. The seed and plant species (tolerant of low pCu), planting locations and density, thinning requirements, and OMM activities would be determined during the remedial design. Phytostabilization could also be effective when combined with remedial technologies that reduce pCu but is considered alone. Monitoring of the areas would be conducted to determine if the pCu values are stable over time and to verify vegetation establishment.

6.3 Surface Water Alternatives – Drainages

Five alternatives have been developed to consider for remediation of the surface water drainages within the STSIU. The drainages being evaluated for remedial alternatives are the yellow drainages on Figure 8-1 that have water quality concentrations higher than water quality standards and have the potential for exposure to a receptor. Alternatives to address both drainage surface water run-off and drainage sediments are listed below. A more detailed description of the technologies is described in section 5. The technology types in the alternatives are listed in Table 6-3.

- Alternative 1: No Action
- Alternative 2: Monitoring
- Alternative 3: Excavation and Monitoring
- Alternative 4 Excavation, Sediment Control, Limestone Treatment, and Monitoring
- Alternative 5: Limestone Treatment and Monitoring
- Alternative 6: Sediment Control, Erosion Control, and Monitoring

6.3.1 Alternative 1: No Action

A no action alternative is included as a baseline comparison to the other remedial alternatives. This alternative would leave the site the way it is for surface water drainages.

6.3.2 Alternative 2: Monitoring

In this alternative surface water drainages would be monitored for natural attenuation for copper against surface water quality criteria parameters.

6.3.3 Alternative 3: Excavation and Monitoring

This alternative would excavate deposited historical sediments from potential aquatic habitat in pools, and upstream of the pools to the extent that the drainages are accessible, in selected or targeted areas along each of the yellow drainages identified in Figure 8-1(i.e., in hot spot removals or receptor locations). Excavation would be conducted only in the drainages and would not extend to the upland soils, as upland soils are addressed in the remedies discussed previously. Long-term monitoring of the surface water quality would be conducted in each of the drainages to document that the surface water quality is improving. This alternative would address historical sediments within the surface water drainages but would have limited impact on new sediments generated from upland soils.

6.3.4 Alternative 4: Instream Removal of Suspended Sediments and Monitoring

In this alternative, sedimentation basins would be constructed within the yellow surface water drainages shown on Figure 8-1. The sedimentation basins would be constructed of limestone rock and slabs to increase the pH of surface water, thereby decreasing the bioavailability of copper in surface water. Construction of the sedimentation basins within existing areas of lower velocity would also provide an opportunity to excavate existing sediments within the surface water drainages in those areas and replace the material with limestone, thereby reducing total copper concentration of in-channel sediments. This alternative would address both the transportation of total copper, as well as dissolved copper concentrations. Long-term monitoring of the surface water quality would be conducted in each of the drainages to document that surface water quality is improving.

6.3.5 Alternative 5: Limestone Treatment and Monitoring

In this alternative, limestone would be placed within the yellow surface water drainages shown on Figure 8-1. The limestone would increase the pH of surface water, thereby decreasing the bioavailability of copper in surface water. The limestone would be placed in areas within the drainage where surface water contact time with the limestone could be maximized (e.g., low gradient reaches, basins, at the bottom of waterfalls/knickpoints, etc.). This alternative would address both the transportation of total copper, as well as dissolved copper concentrations. Long-term monitoring of the surface water quality would be conducted in each of the drainages to document that surface water quality is improving.

6.3.6 Alternative 6: Sediment Control, Erosion Control, and Monitoring

In this alternative BMPs and slope changes would be made to prevent the movement of suspended sediments from entering surface water drainages. This alternative would be most appropriate for areas where upland treatments or removals are not conducted. BMPs would be installed along select locations along the length of the yellow surface water drainages in Figure 8-1. Targeted stream length would be in areas with the highest potential for sediment loading. This alternative would address suspended sediment contribution to total copper concentrations and potential loading of sediments to the surface water drainages. This alternative would require long-term monitoring of surface water quality to determine if it is improving as well as monitoring and maintenance of the constructed/installed BMPs. Preference should be given to BMPs or controls that include a limestone component which may address the dissolved phase of metals in storm water.

6.4 Surface Water Alternatives – Stock Tanks

Five alternatives have been developed to consider for remediation of the surface-water fed, earthen stock tank 6 within the STSIU. The remedial alternative for the stock tank is linked to the remedial alternatives selected for surface water drainages, discussed in Section 6.3. The alternatives are summarized in Table 6-4.

- Alternative 1: No Action
- Alternative 2: Monitoring
- Alternative 3: Excavation and Monitoring

6.4.1 Alternative 1: No Action

A no action alternative is included as a baseline comparison to the other remedial alternatives. This alternative would leave the site for surface water drainages.

6.4.2 Alternative 2: Monitoring

In this alternative monitoring of the surface water stock tank would be conducted for surface water quality parameters and potential natural attenuation.

6.4.3 Alternative 3: Excavation and Monitoring

In this alternative the stock tank would be excavated to remove the historical sediment from the bottom of the tank. Excavated soil would be taken to the operation area for subsequent reuse. Monitoring of the stock tank would be required to document that the water quality in the stock tank meets regulatory standards.

7. Analysis of Alternatives

The remediation alternatives developed in Section 6 are evaluated in this Section. A final remediation alternative is recommended for each remedial component (soils – total metals, soils – pCu, surface water drainages, and a surface water stock tank).

The descriptions provided below include the major activities for each remedy at sufficient level of detail for the purposes of this FS. Detailed designs, sampling and analysis plans, inspection and monitoring plans, and other documents necessary for implementing the alternatives will be prepared at a later date after the remedy has been selected and documented in the ROD. Remedial alternative analysis is based on the following USEPA evaluation criteria:

- overall protection of human health and the environment;
- compliance with ARARs;
- long-term effectiveness and permanence;
- reduction of toxicity, mobility, or volume;
- short-term effectiveness;
- implementability; and
- cost;

In addition to the above standard USEPA evaluation criteria, the remedial alternatives will be evaluated using green remediation criteria. Factors for each remedial alternative that will be evaluated will also be evaluated as a green alternative, which may include, but may not be limited to, conservation of natural resources, carbon footprint, greenhouse gas emissions, and sustainability of the design.

The first two criteria are considered threshold criteria. Threshold criteria are minimum requirements that must be satisfied by an alternative. These criteria are applied to individual alternatives, but not used in the comparative evaluation of alternatives. The next five are the balancing criteria. Comparative evaluation is based on the balancing criteria used to assess tradeoffs between each alternative.

The USEPA includes two more criteria not in the above list, state and community acceptance, which are modifying criteria and are more difficult to assess at the initial FS stage. Typically, after the FS is out for public review, the FS is finalized with reference to these two criteria. Alternatively, after the FS is finalized, an alternative is selected as the proposed remedial action. The proposed remedial action is described along with the basis for its selection in the Proposed Plan. The evaluation of the modifying criteria is based on the state and public comments on the FS and the Proposed Plan. State and community concerns, and any resulting changes in the selected remedial actions, are documented in the ROD for the site. Therefore, the two modifying criteria are not evaluated in this document.

Each of the remedial alternatives have been summarized in Table 7-1 through 7-4 for: soils – total metals, soils – pCu, surface water drainages, and surface water stock tanks. A summary of the areas, drainage length and stock tanks involved is presented below. The selection of a remedial alternative for the upland soils will focus on the 140 acres identified for monitoring for copper concentrations in abiotic and biotic media (none were identified for active remediation for copper), and the 377 acres carried forward for pCu requiring active remediation. The areas requiring active remediation or monitoring for soils are presented in Figure 8-1. The selection of a remedial alternative for surface water will focus on the drainages with watershed-specific HQs $\geq$ 1 for WER-adjusted copper concentrations in ephemeral drainages, which are A, C1, C2, D2, and D3 Drainages in addition to stock tank 06 (Figure 8-1).

7.1 Evaluation Criteria

7.1.1 Threshold Criteria

Under CERCLA, remediation alternatives must meet the following two threshold requirements:

- overall protection of human health and the environment;
- compliance with ARARs;

7.1.1.1 Protection of Human Health and Environment

This criterion addresses the degree to which the remediation alternative is protective of human health and the environment, considering both long-term and short-term risks. Overall protectiveness is a threshold criterion, in that those alternatives that do not achieve adequate protection of human health or the environment are eliminated from further consideration. The ability of the alternatives to achieve remedial action objectives is part of the evaluation of this criterion. This criterion considers the evaluation of other criteria, especially long-term effectiveness and permanence; reduction of toxicity, mobility and volume; and short-term effectiveness. This is a summary of the overall evaluation of these other criteria. Because the overall protection of human health and the environment is a summary evaluation, it is evaluated for screening individual remediation alternatives, but not used in comparative evaluation of the alternatives.

7.1.1.2 Compliance with ARARs

This criterion addresses whether or not the alternative meets ARARs, which were defined in Section 2. As with overall protectiveness, compliance with ARARs is a threshold criterion that must be met for an alternative to be selected.

7.1.2 Balancing Criteria

7.1.2.1 Long-term Effectiveness and Permanence

This criterion addresses the results of remedial actions in terms of the risk remaining at the site after the response action objectives have been met and the reliability of the remedial action at reducing risks over an extended period of time. The primary focus of this evaluation is the extent and effectiveness of the control that may be required to manage the risks posed by the contaminants in the long-term.

7.1.2.2 Reduction of Toxicity, Mobility, or Volume through Treatment

This criterion addresses the degree to which a remediation alternative, through treatment (not through removal or covering) reduces the toxicity of contaminants, the ability of the contaminants to migrate into the accessible environment, or the volume/quantity of the contaminated material. This criterion focuses the analysis of the preference for treatment under CERCLA. Effectiveness and reliability of treatment are addressed under long-term effectiveness and permanence, and are not addressed under this criterion.

7.1.2.3 Short-term Effectiveness

This criterion addresses short-term effects on human health and the environment while the alternative is being implemented. The following factors should be addressed as appropriate for each alternative: protection of community and workers during construction, environmental impacts, amount of time to implement the remedial actions.

7.1.2.4 Implementability

This criterion addresses the degree of difficulty in implementing each alternative. Implementability can be divided into three categories: technical feasibility, administrative feasibility, and availability of services and materials. Implementability is a key criterion for more complex alternatives and reliance on innovative technology increases. Implementability issues are important because they address the potential for schedule delays, costs increases, and remedy failure to achieve the intended results. The evaluation considers the following:

- *Technical Feasibility.* Addresses site-specific factors that could prevent successful implementation of an alternative. As previously mentioned in Section 6 implementability issues could include physical interferences, such as bedrock, steep slopes or limited access.
- *Administrative Feasibility.* The degree of difficulty anticipated due to regulatory constraints such as permit approvals and degree of coordination between regulatory agencies and stakeholders.
- *Availability of Services and Materials*. The availability of labor, equipment and materials to implement the alternatives.

7.1.2.5 Cost

The criterion is used to consider the costs of implementing each alternative including capital costs and operating, monitoring, and maintenance costs. Costs that are excessive compared to the overall effectiveness may be considered as one of several factors used to eliminate an alternative. Alternatives providing effectiveness and implementability similar to that of another alternative, but at a higher cost, may be eliminated. Appendix F presents the supporting cost information. Components of Appendix F include:

- Capital cost estimates, with supporting narrative regarding the source(s) of component unit costs (e.g., RS Means, etc.);
- Monitoring cost estimates, with supporting narrative regarding the source(s) of the component unit costs;
- Periodic costs estimates, with supporting narrative regarding the source(s) of the component unit costs; and
- Net present value cost estimates for each alternative that combine the capital, annual monitoring, and periodic costs, including the selected discount factor and justification for its use, frequency for periodic costs, and overall time duration for the net present value calculations.

All component cost estimates are linked to specific references.

7.1.3 State and Community Acceptance

These last two evaluation criteria are not evaluated in the STSIU FS. These criteria will be addressed in the ROD.

7.1.4 Green Remediation

Factors for each remedial alternative that will be evaluated will also be evaluated as a green alternative, which may include, but may not be limited to, conservation of natural resources (fuel), carbon footprint, greenhouse gas emissions, and sustainability of the design.

7.2 Evaluation of Soils Alternatives – Total Metals

As presented in Section 3, all sample-specific concentrations were less than the 5,000 mg/kg copper and 100,000 mg/kg Fe, as specified by the Pre-FS RAC for human health, except in IRA areas where removal could not be accomplished due to bedrock, infrastructure or steep slopes. All habitat alliance polygons had a 95UCL area-weighted average copper concentration less than 1,600 mg/kg and meet the avian pre-FS RAC. Three polygons had 95UCL area-weighted average copper concentrations between 1,100 and 1,600 mg/kg (1-3, 10-16 and 88-15). It is therefore appropriate to evaluate non-active remedial alternatives for these acres.

The alternatives are summarized as:

- Alternative 1: No Action
- Alternative 2: Monitoring

Using the 95UCL area-weighted average concentrations, 140 acres were identified within the monitoring range of the avian pre-FS RAC (1,100 to 1,600 mg/kg), but no acres exceed the SGFB Pre-FS RAC of 1,600 mg/kg. Thus, Alternatives 1 and 2 are evaluated further below and alternatives with active treatment (Alternatives 3, 4, and 5) are not appropriate based on current conditions; Alternatives 1 and 2 are detailed further in Table 7-1.

7.2.1 Detailed Analyses of Soil Alternatives – Total Metals

This section presents a detailed analysis of the copper soil remediation alternatives for each of the threshold and balancing criteria described in Section 7.1, above.

7.2.1.1 Alternative 1: No Action

Protection of Human Health and the Environment

The No Action alternative does not provide any additional protection of human health and the environment. However, this alternative meets the human health pre-FS RAC for copper and iron and the part of the avian pre-FS RAC that specifies copper concentrations should be less than 1600 mg/kg. It does not meet the monitoring requirement for copper concentrations between 1100 and 1600 mg/kg, and thus does not fully meet the RAOs.

Compliance with ARARs

There are no chemical-specific ARARs for surface soil except for the pre-FS RAC, which would not be met for monitoring of copper to protect wildlife. However, the portion of the pre-FS RAC that requires active remediation when copper > 1600 mg/kg is met with the no action alternative because no exposure units exceeded 1600 mg/kg.

Long-term Effectiveness and Permanence

The magnitude of residual risk (i.e., potential for unacceptable risk to wildlife over the long term) could change from current conditions. Therefore, this alternative would not be acceptable for long term effectiveness or permanence because it does not include monitoring.

Reduction of Toxicity, Mobility, or Volume

The No Action alternative does not reduce the toxicity, mobility, or volume because no treatment would be implemented.

Short-term Effectiveness

The No Action alternative would be effective in the short term because current conditions are protective as they meet the human health pre-FS RAC and the avian pre-FS RAC such that active remediation is not required. No actions would be implemented so there would be no risks to the community or workers or impacts to the environment during implementation.

Implementability

No actions would be implemented so this alternative is implementable. The No Action alternative would not limit further actions at STSIU and no approval or coordination with other agencies would be necessary.

Cost

There is no cost associated with the No Action alternative. The No Action alternative provides a baseline for comparison of other alternatives.

7.2.1.2 Alternative 2: Monitoring

Protection of Human Health and the Environment

The Monitoring alternative does not directly provide any additional form of overall protection of human health and the environment beyond current conditions. However, the ability of the Monitoring alternative to satisfy this threshold criteria is high and achievable because it meets the requirements of the pre-FS RAC. The acres involved do not require remediation because the concentrations currently do not pose risk to human health and the environment; however, they do require monitoring based on the pre-FS RAC. The monitoring in this alternative ensures current conditions between 1100 mg/kg and 1600 mg/kg copper do not change and adversely affect the small ground feeding bird. If conditions change adversely, monitoring may trigger a remedial alternative over time designed to improve protection of human health and the environment.

Compliance with ARARs

There are no chemical-specific ARARs for surface soil except for the pre-FS RAC, which is met with this alternative by monitoring exposure units with copper in soils between 1,100 mg/kg and 1,600 mg/kg, and given no exposure units exceed the active remediation threshold of 1,600 mg/kg. The Monitoring alternative would meet the threshold criterion of compliance with ARARs.

Long-term Effectiveness and Permanence

The magnitude of risk would be consistent with current conditions unless monitoring shows an adverse change in results that requires the implementation of additional remedial actions. More likely, natural attenuation will lower copper in soils due to erosion of surface soils with copper and deposition of cleaner windblown and colluvial soil over time. This alternative affords the opportunity to continue data collection and to take additional action if necessary.

Reduction of Toxicity, Mobility, or Volume

The Monitoring alternative does not reduce the toxicity, mobility, or volume because no treatment would be implemented.

Short-term Effectiveness

The Monitoring alternative would be effective in the short term because current conditions are protective as they meet the human health pre-FS RAC and the avian pre-FS RAC such that active remediation is not required. No remedial actions would be implemented so there would be no risks to the community or workers or impacts to the environment during implementation.

Implementability

Monitoring would be readily implementable. This alternative would not limit further actions at STSIU and no approval or coordination with other agencies would be necessary beyond monitoring coordination.

Cost

The present value cost of this alternative is $1.04 million (see Appendix F).

7.2.2 Comparative Analyses of Soil Alternatives – Total Metals

Table 7-1 provides a comparative analysis for the two alternatives for addressing total metals in soils. For the 140 acres for which monitoring is indicated based on 95UCL area weighted average concentrations between 1,100 and 1,600 mg/kg, Alternative 1 does not meet the threshold criteria because the acres do not meet the Pre-FS RAC for monitoring and, therefore, do not meet the state's criteria. Alternative 2 is monitoring and this remedial alternative meets the state's Pre-FS RAC. Alternative 2 is also considered the greenest remediation alternative behind Alternative 1. Based on the amendment, pH and insect studies, the white rain in 2008 reduced copper uptake into plants and thus reduced phytotoxicity, and improved plant richness. However, NMED (2011a) indicates that:

> *If the 95UCL area-weighted average copper concentration in an exposure unit exceeds 1,100 mg/kg, Chino shall propose risk-based monitoring of abiotic and/or biotic media to help ensure that risk from copper exposure of small ground-feeding birds in the exposure unit do not exceed acceptable levels. A protectiveness assessment consistent with CERCLA guidance will be conducted on a population basis. This requirement is intended to offset the uncertainty in risk conclusions for this area due to the paucity of soil and invertebrate data available to characterize risk since the cessation of smelter operations and the 'white rain' event of January 2008. This monitoring shall include, at a minimum, ground-dwelling invertebrates, an indicator of copper exposure to birds that feed primarily on invertebrates during critical life stage. This requirement is intended to offset uncertainties in estimated copper exposure between 1,100 and 1,600 mg/kg. Monitoring shall be conducted in intervals no greater than 2 years for the first 5*

years to establish a trend within the first 5 year review period. Monitoring frequency beyond the first years will be determined based on the first 5 year review recommendations.

A monitoring work plan will be submitted as part of the basis of design after the ROD is issued. Total estimated cost is $1.04MM.

7.3 Evaluation of Soils Alternatives – pCu

As described in Section 3, nearly 4,000 acres of upland have been remediated or reclaimed through interim actions and soil removals under reclamation. Of the remaining acres, the flat granular soil category had mean pCu concentrations less than its respective PEL, and no acres of this soil category are retained for remediation. The acres associated with retained rangeland polygons in bedrock, flat rocky, and slope >13% soils types with PEL values of 4.4, 4.98, and 4.11 respectively, amounted to 377 acres, with 47, 313, and 17 acres in bedrock, flat rocky, and slope soils. These acres brought forward for remedial analysis were evaluated across the eight remedial alternatives for the threshold and balancing criteria (Section 7.3.1, below).

As discussed in Section 6, the remedial alternatives are:

- Alternative 1: No Action
- Alternative 2: Monitoring
- Alternative 3: Excavation (Reuse or Disposal) and Monitoring
- Alternative 4: Soil Amendments (Lime), Tilling, and Monitoring
- Alternative 5: Tilling and Monitoring
- Alternative 6: Soil Amendments (Ferrihydrite), Tilling, and Monitoring
- Alternative 7: Soil Cover and Monitoring
- Alternative 8: Surface Soil Controls: Phytostabilization

7.3.1 Detailed Analyses of Soil Alternatives – pCu

This section presents a detailed analysis of the pCu soil remediation alternatives for the plant community for each of the threshold and balancing criteria described in Section 7.1.

7.3.1.1 Alternative 1: No Action

Protection of Human Health and the Environment

The No Action alternative does not provide any additional protection of human health and the environment beyond current conditions. A number of acres (313 for flat rocky, 47 for bedrock, and 17 for slope soils) were carried forward for consideration for remediation for exposure units that were below the estimated mean pCu PELs of 4.98, 4.11, 4.11, and 4.40 for the flat rocky, slope, flat granular, and bedrock soil categories, respectively. However, in some flat rocky areas with pCu between 4.6 and 4.98, estimated risk of pCu exposure may be biased high, and the risk may not fully consider other adverse effects to the plant community from remediation (discussed below when comparing the other alternatives). Lower PELs could be technically justifiable, particularly for flat rocky soils, which would mean the No Action alternative could be protective in some of the acres carried forward.

The No Action alternative may be protective of human health and the environment for areas between 4.6 and pCu of 4.98. The reasons are outlined below.

- OAT score not included in PEL calculation. The average of richness and cover was used to estimate the PEL for wildlife habitat, the more sensitive parameter than rangeland condition. This average, empirically measured in the field to represent wildlife habitat, does not adequately incorporate compaction due to grazing that occurs in flat rocky soils. Richness is problematic, because it can increase with an increase in pCu in highly compacted soils; whereas, plant cover does not, as shown by the amendment (Appendix A) and pH monitoring studies (Appendix B), where tiny species increased but plant cover did not respond to an increase in pCu. An average PEL that included the OAT score in its calculation (4.6 for flat rocky soils, 3.83 for bedrock soils, and 2.97 for slope and flat granular soils, Table D-7 in Appendix D), as well as richness and cover likely would better represent the improvement of quality of the habitat for wildlife with a change in pCu.
- Grazing impacts independent of pCu not fully incorporated. Many areas of the STSIU with poor vegetative cover in flat rocky soils have likely *not* been impacted by pCu but rather were unsustainably grazed until the 1970s when management improved on public lands with passage of the Federal Lands Policy and Management Act, which also influenced practices on private lands. Based on Chino's records over 20 years starting in 1984, there was moderate level grazing for the area's productivity, and even though ranching practices were improving, moderate grazing may be unsustainable for the soil types that are present, even if pCu is well above 5. Soil productivity was surveyed by U.S Agricultural Survey and results published in a Soil Conservation Survey (NRCS 1983); the soil types present in the flat rocky portions of the STSIU include Encierro and Muzzler rock complexes, Santana Rock outcrop, and Lonti gravelly loam (Table F-4 of Attachment C). Specifically, NRCS classifies these soil types as "very poor" for grasses (rating of very poor indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected, NRCS 1983). Therefore, these soils generally lack the productivity to support even moderate grazing, and the A horizon of soil types may erode under grazing pressure resulting in a loss of palatable herbaceous cover, as discussed in Schafer and Associates (1999a) and Bestelmeyer et al. (2004). The effect of grazing was supposed to be incorporated into the unacceptability criteria and PELs used to screen acres for this detailed remediation analysis by comparing vegetation in site flat rocky soils to a grazed flat rocky reference area, but the grazed reference area for flat rocky selected was a poor representation of this type of soil, as it was more of an intermediate soil category between bedrock and flat granular types and was a different soil type, Lehmans extremely rocky loam. Acres carried forward may be biased high for flat rocky if the flat rocky reference area is a more productive habitat type.
- Greenhouse results support lower PELs for flat rocky soils. The greenhouse results in Appendix C produce lower PELs than the field community study PELs used in this FS (but they only consider the chemical effect of pCu). Based on the seedling emergence endpoint, which is most correlated to richness and cover in the STSIU plant communities (Appendix C), the PEL would average 4.6 for the native, sensitive species (sideoats grama and tansyaster). The field-sourced seeds actually had lower average PELs (4.4) than the nursery sourced seeds (4.7) for the sensitive species. The average PEL for emergence across all species tested in the greenhouse is 4.4 and the alfalfa PEL alone was 3.7.
- Adjusting greenhouse results to match field conditions still suggests lower PELs for flat rocky soils. The greenhouse results rely on soil samples that were homogenized (in both the 1999 and 2014 studies), and the samples did not retain the structural effects of the soil condition as seen in the field (in bedrock or compacted). The results are less representative of real-world conditions than the plant community results collected in the field for richness, cover, and OAT score. As an example of discrepancies, the greenhouse

results for lower pCu soils often indicated zero emergence; whereas, the field location of the same soils had growing plants. This result suggests native plants in their natural condition are not as sensitive as the greenhouse results indicate. The greenhouse results do not include physical effects of micro-scale heterogeneity of pCu and soil compaction, nor erosion, on vegetation endpoints that may have occurred, either due to grazing or the effects of pCu or both. If such effects allow more emergence, then the greenhouse pCu is overestimated (i.e., PELs biased high). It is possible to statistically account for the effect of pCu on soil condition, where soil condition is calculated as the sum of the three soil factors in the OAT score; however, it requires analyses that separate the soil category effects (e.g., flat rocky vs. other types) from pCu effects when predicting soil condition and then an in-depth modelling method that adds a portion of the structural effect back. Such modelling could be conducted in the future and is not presented herein.

Therefore, given the uncertainties in the effects of pCu on vegetation communities ranging from the mean of all endpoint PELs for each soil category (Table D-7 in Appendix D) to the higher of either the wildlife habitat or rangeland condition PEL for each soil category (method discussed in Section 3.2.4), the No Action alternative may be more protective for the vegetation community as a whole compared to active remedies that may destroy vegetation communities in the short-term (short term may still be decades in semi-arid ecosystems) as discussed in the various remedial alternatives below.

Compliance with ARARs

There are no chemical-specific ARARs for surface soil except for the pre-FS RAC. Compliance with the ARARs is low because some acres do not meet the pre-FS RAC.

Long-term Effectiveness and Permanence

The magnitude of residual risk (i.e., potential for unacceptable risk to vegetation over the long term) would be consistent with current conditions. There could be changes to pCu in surface soil due to changes in pH over time, either improving or not improving with no action. Therefore, it is unclear if this alternative is acceptable for long term effectiveness or permanence.

Reduction of Toxicity, Mobility, or Volume

The No Action alternative does not reduce the toxicity, mobility, or volume because no treatment would be implemented.

Short-term Effectiveness

This alternative is more effective in the short term at protecting the plant community than active remedies, which destroy or damage the plant community. It is less effective at protecting the community in long-term where pCu exposure is the main risk, depending on the clean-up level selected. No actions would be implemented so there would be no risks to the plant community or impacts to the environment during implementation.

Implementability

No actions would be implemented. This Alternative 1 would not limit further actions at STSIU and no approval or coordination with other agencies would be necessary.

Cost

There is no cost associated with the No Action alternative. The No Action alternative provides a baseline for comparison of other alternatives.

7.3.1.2 Alternative 2: Monitoring

Protection of Human Health and the Environment

Similar to the No Action alternative, the Monitoring alternative does not provide any additional protection of human health and the environment beyond current conditions. The level of protection for plants is the same as discussed for the No Action Alternative 1, except monitoring provides a mechanism to determine if conditions change and a different action is required. As discussed for the No Action Alternative, the Monitoring alternative may be more protective for the vegetation community in areas of flat rocky soils at pCu between the average PEL of all endpoints (4.6) and the selected PEL in Section 3.2.4 (4.98) because it does not require destruction of the vegetation community during implementation. The net environmental benefit of more active remedies is more certain in flat rocky areas where pCu < 4.6. Similarly, monitoring may be more protective of bedrock and slope sols at pCu values between the average PEL (3.83, and 2.97 for bedrock and slope, respectively) and selected PEL (4.11 and 4.4 for bedrock and slope, respectively) where the effect to the vegetation community is more uncertain than in areas with pCu < 3.83 for bedrock and < 2.97 for slope soil. Additionally, monitoring may be more protective in these soil types because no polygons had bedrock pCu < 3.83 or slope soil pCu < 2.97, where benefits of active remediation would be more certain.

Compliance with ARARs

There are no chemical-specific ARARs for surface soil (except for the pre-FS RAC). Because no actions would be taken, there are no action-specific or location-specific ARARs for this alternative. The likelihood of compliance with the ARARs on an ongoing basis is low.

Long-term Effectiveness and Permanence

The magnitude of residual risk (i.e., potential for unacceptable risk to vegetation over the long term) would be consistent with current conditions. There could be changes to pCu in surface soil due to changes in pH over time, either improving or not improving. Therefore, it is unclear if this alternative is acceptable for long term effectiveness or permanence.

Reduction of Toxicity, Mobility, or Volume

The Monitoring Alternative does not reduce the toxicity, mobility, or volume because no treatment would be implemented.

Short-term Effectiveness

This alternative is more effective in the short term than active remedies because, unlike active remedies, it does not initially destroy the plant community being protected. No actions would be implemented so there would be no risks to the community or workers or impacts to the environment during implementation.

Implementability

Monitoring would be readily implementable. Alternative 2 would not limit further actions at STSIU; however, a monitoring plan would need to be coordinated with NMED.

Cost

The present value cost of this alternative is about $1.9 million (see Appendix F).

7.3.1.3 Alternative 3: Excavation (Reuse or Disposal) and Monitoring

Protection of Human Health and the Environment

This alternative would remove soils with concentrations at levels that could pose a potential risk to vegetation from copper and pH (quantified as pCu). The removal of the topsoils could leave unproductive, compacted soils underneath that may be difficult for vegetation growth to establish quickly in this semi-arid environment, even after borrow is placed and the area seeded. Removal of soils has been effective at producing productive plant communities in interim action areas using such techniques (e.g., Arcadis 2014c) although not enough time has elapsed to establish the original plant communities. Also, it is also important to underscore the net environmental benefit of this remedial alternative. The plants are directly destroyed in the remediation, and the harm from destruction of the plants “to benefit plants” and the potentially long recovery period required for the entire plant community to return to and potentially exceed pre-remediation habitat function in the semi-arid southwest might outweigh the effects of pCu on the vegetation community. Protectiveness of the plants as a wildlife and livestock food source is an important criterion to consider in the FS, which may be lost until the community recovers from remediation. Any active remedy such as excavation of flat rocky soils would destroy the entire community, including both less sensitive species that are thriving and more sensitive species that would benefit in the long term. The entire community may require a significant period of time to return to pre-remediation conditions. Site-specific data show that pCu has a significant effect on the plant community. However, as discussed in the 7.3.1.1, there is some uncertainty in the degree of protection provided at the selected PELs versus PELs that incorporate the mean effects to both wildlife habitat and the less sensitive rangeland condition endpoint. Active remedy conducted at pCu between 4.6 and 4.98 for flat rocky soils (and between 3.83 and 4.4 for bedrock and between 2.97 and 4.11 for slope soils) may improve soil conditions for more sensitive species, but there may be a limited net benefit to wildlife habitat overall because all vegetation species are simultaneously destroyed the implementation of the action; the potential for effect from pCu in that range is uncertain. No areas of bedrock soils with pCu < 3.83 or slope soils with pCu < 2.97, bedrock and slope areas with more certain benefits from this Alternative, were identified. The number of acres identified for active remedy in flat rocky soils reduces 3-fold between PELs of 4.98 to 4.6, see Table 7-3 (below).[16] A lower PEL than 4.98 for flat rocky is technically justifiable as discussed in Section 7.3.1.1 and using a slightly lower PEL (e.g., 4.6) that incorporates both the wildlife habitat and rangeland condition endpoints would disturb less land and may be more beneficial to the overall ecosystem. A lower PEL would be consistent with the phytotoxicity and community study results overall and incorporate effects on the soil structure due to grazing and land practices over time.

Once the ecosystem re-establishes, eventually maturing to its previous successional stage (possibly after decades in this semi-arid ecosystem), Alternative 3 would meet the threshold criterion of overall protection of human health and the environment. The same is true for bedrock and slope soils, since the plant communities will be destroyed until recovery and a slightly lower PEL may be more protective.

[16] Table has removed acceptable wildlife habitat or acceptable rangeland. The already remediated Bolton Diversion is part of a rangeland polygon HE-216 retained because pCu is still lower than the PEL even with that area averaged in with the other flat rocky acres (see Figure 3-12 vs. Figure 3-13). However, its acres are excluded from the acres in Table 7-3 because it will not require remediation.

Table 7-3. Flat Rocky Acres less than PELs ranging from 4 to 4.98

pCu	Acres
4	3.4
4.1	3.4
4.2	67.1
4.3	67.1
4.4	87.3
4.5	87.3
4.6	112.5
4.7	164.2
4.8	187.1
4.9	312.8
4.98	312.8

Compliance with ARARs

There are no chemical-specific ARARs for surface soil except for the pre-FS RAC. Action-specific and location-specific ARARs (Tables 2-2 and 2-3) would be met by remedial design. Alternative 3 is expected to meet the threshold criterion of compliance with ARARs if careful attention is given to restoring the soil productivity and plant community after soil removal.

Long-term Effectiveness and Permanence

This alternative would provide protection over the long term for soil categories that can be excavated. Removal is a proven and reliable method of preventing the potential for contact with materials of concern. Monitoring of erosion from removal areas and soil sampling would be required to ensure that recontamination did not occur. However, as described above, excavation at pCu at < PELs for the soil categories would temporarily destroy the entire community, including both less sensitive and more sensitive species, and many species may not return for an extended period of time. Alternative 3 would provide a high level of long-term effectiveness and permanence after species return.

Reduction of Toxicity, Mobility, or Volume

This alternative would not meet the statutory preference for treatment. Alternative 3 does not reduce the toxicity, mobility, or volume because no treatment would be implemented; only contaminated soil will be removed.

Short-term Effectiveness

Alternative 3 would be ineffective at achieving the goal of protecting the vegetation community, wildlife habitat, and rangeland in the short term. As described above, excavation would destroy the entire community, including both less sensitive and more sensitive species, and many species may not return for an extended period of time. When active remedy occurs at < PELs, the whole community is affected by this remedy. While there is some gain to improve soil conditions for more sensitive species, there is limited short-term effectiveness because all species are simultaneously destroyed. Also, Alternative 3 would entail significant earthwork which would result in a risk to workers due to physical hazards, particularly working on steep and potentially unstable slopes. Placing heavy equipment on slopes to regrade them could increase the risk of slope failure. Site preparation, soil excavation, transport and disposal onsite are significant construction activities that will require transport of heavy equipment to the site. In addition, the use of heavy equipment for grading and earthwork would release diesel emissions into the environment.

Implementability

This alternative is considered moderately implementable. Excavation would not be implementable in areas of bedrock outcrops or steep slopes. Of the 377 acres, 47 are on bedrock and 14 are on steep slopes. The presence of these two physical factors limits the implementability of this alternative in these areas. Soil excavation, transportation and onsite disposal can be achieved in flat rocky soils with standard equipment and materials. Site preparation will include building new roads for haulage. Excavated soil would either be taken to the operational area for subsequent reuse or taken to the West Stockpile for recycling (disposal option).

Cost

The present value cost of this alternative is $11.1 Million (see Appendix F).

7.3.1.4 Alternative 4: Soil Amendments (Lime), Tilling, and Monitoring

Protection of Human Health and the Environment

The ability of this alternative to satisfy this protection criterion is high on relatively level habitats, particularly if on poor rangeland. Success of this remedial technology in protecting the plant community was defined in the amendment study (Appendix A) as an increase in soil pCu, decrease in copper concentration in plant tissue, an increase in plant species richness and cover, an increase in rangeland grass cover, and a reduction in undesirable plant species (toxic, non-native). Lime (in form of white rain) alone increased pCu, decreased plant uptake of copper, and increased species richness but not cover. Tilling has been shown to be effective on the site at also increasing cover (e.g. for ripped roads, see Section 5.3.3.3 in Appendix A). Copper present in surface soils would be tilled and mixed deeper into the soil along with bringing higher pH soils to the surface. Tilling also provides the benefit of breaking up the soil to allow plant growth. The addition of lime in areas with tilling or where tilling is impractical could also increase pCu in soils and reduce the bioavailability of any remaining copper. Notably, the amendment study found the increase in pCu in steep slopes and benefit to plant community was less than in flatter slopes, likely due to runoff of the lime. Also, lime alone in form of white rain did not substantially increase plant or grass cover, but did improve richness. Thus, lime alone is expected to have a low to moderate ability to satisfy this criterion.

Similar to Alternative 3, it is important to underscore the net environmental benefit of this remedial alternative. The plants are directly destroyed in the tilling and are adversely impacted even with only lime amendment application (see Appendix A results). The destruction of the plants “to benefit plants function as wildlife habitat” and the potentially long recovery period required for the entire plant community to return to and potentially exceed pre-remediation habitat function in the semi-arid southwest might outweigh the impact of effects of pCu on the vegetation community, depending on the pCu of the PELs. Protectiveness of the plants as a food source is an important criteria to consider in the FS, which may be lost until the community recovers from remediation. Any active remedy such as tilling of flat rocky soils would destroy the entire community, including both less sensitive species that are thriving and more sensitive species that would benefit in the long-term. The entire community may require a significant period of time to return to pre-remediation conditions. Site-specific data show that pCu has a significant effect on the plant community; however, there is some uncertainty in the degree of protection provided at the selected PELs versus PELs that incorporate the mean effects to both wildlife habitat and the less sensitive rangeland condition endpoint. Active remedy conducted at pCu between 4.6 and 4.98 for flat rocky soils (and between 3.83 and 4.4 for bedrock and between 2.97 and 4.11 for slope soils) may improve soil conditions for more sensitive species, but there may be a limited net benefit to wildlife habitat overall because all plant species are simultaneously affected by the action and the potential for effect from pCu in that range is uncertain. A lower PEL than 4.98 for flat rocky could be technically justifiable as discussed in Section 7.3.1.1 and using a lower PEL (e.g.,4.6) would disturb less land and may be more beneficial to the overall ecosystem. A lower PEL would be consistent with the phytotoxicity study and incorporate changes to the soil structure due to grazing and land practices over time. Once the ecosystem re-establishes, Alternative 4 would meet the threshold criterion of overall protection of human health and the environment.

Compliance with ARARs

There are no chemical-specific ARARs for surface soil except for the pre-FS RAC. Action-specific and location-specific ARARs (Tables 2-2 and 2-3) would be met by remedial design. Alternative 4 would likely meet the threshold criterion of compliance with ARARs if tilling is included. It is less certain on steeper slopes where lime has run off and has been less effective. Tilling breaks up the compacted soils of flat rocky soils and is likely to improve the plant community in such soils, although pCu may not always reach the flat rocky PEL of pCu ≥ 4.98 because, although pH may increase, copper may not be reduced enough (see Amendment study in Appendix A where pCu change was not statistically significant). The breaking up of the compacted soils is the main benefit, and the compaction likely is due to grazing and/or pCu effects.

Long-term Effectiveness and Permanence

The long-term effectiveness of this alternative to meet some if not all of these metrics is considered moderate for amendments for improving pCu but high for tilling for improving the plant community if in flat rocky soils. Lime (calcium carbonate) has been shown to significantly increase pH values at the site (Appendix A) but does not always increase pCu values in flat rocky soils at the site to pCu of 4.98. As described above, tilling at pCu < 4.98 for flat rocky soils would temporarily destroy the entire community, including both less sensitive and more sensitive species, and many species may not return for an extended period of time. Alternative 4 would provide a high level of long-term effectiveness and permanence after species return. Its effectiveness in bedrock and on steep slopes at pCu < 4.4 and < 4.11, respectively is low, given tilling cannot be done in bedrock and tilling equipment is difficult to use on steep slopes. Liming may be more effective in bedrock and steep slopes, but the effectiveness is uncertain because lime is easily washed off with rainfall in these areas. Additional applications of soil amendments may be required in bedrock outcrops or on steep slopes due to transportation of material from storm water flows.

Reduction of Toxicity, Mobility, or Volume

This alternative would mix the upper soil layers with underlying soils, increasing pCu and decreasing toxicity and amount of acid in the soils. Also, adding lime would reduce the bioavailability and mobility and thus toxicity of the copper.

Short-term Effectiveness

This alternative would not be considered effective in the short-term. Mixing of surface soils with deeper soil layers resulting from tilling is expected to increase pH, decrease soil copper, and improve conditions for plant growth. However, it may take several years for the soil amendments to increase the pCu values. Also, as described above, tilling or liming at pCu of < 4.98 in flat rocky soils (and < 4.4 in bedrock and < 4.11 in slope soils) would destroy or impact the entire community, including both less sensitive and more sensitive species, and many species may not return for an extended period of time. If lime is only applied (no tilling), as it was on steeper slopes in the amendment study (only up to 13% slope), it may still adversely impact the plant community in the short term (observed during amendment study), and only slightly increase the pCu. The benefit is likely greater for steep slopes in poor rangeland condition. The three step approach this FS used to identify acres for remediation of pCu often, but not always removed fair to good rangeland condition areas from consideration, increasing the likelihood that lime treatment alone might be effective, particularly on relatively level acres, and it may be somewhat effective on bedrock in the short term where tilling cannot occur (but may wash off with rainfall greatly reducing its short-term benefit). When active remedy occurs in areas < PELs, the whole community is adversely affected by the remedy in the short term. While there is some gain to improve soil conditions for more sensitive species, there is limited short-term effectiveness because all species are simultaneously destroyed by tilling or reduced by lime application if no tilling occurs on steeper slopes.

Implementability

The implementability of soil amendments is considered high compared to the other alternatives. If tilling is excluded, it is an alternative that could be applied to areas with steep slopes and bedrock outcrop areas, which cannot be addressed by physical means. However, additional applications of soil amendments may be required in the future in bedrock outcrops or steep slopes due to the transportation of amendments in storm water. Tilling is considered moderately implementable as it could not be used in areas of bedrock outcrops or steep slopes but is effective in flat rocky soils.

Cost

The present value cost of this alternative is $6.4 million (see Appendix F).

7.3.1.5 Alternative 5: Tilling and Monitoring

Protection of Human Health and the Environment

The ability of this alternative to satisfy this criterion is high for slopes that are not too steep. As stated in the amendment study that evaluated this particular remedial technology over a 5-year period, success of this remedial technology in protecting the environment is defined as an increase in soil pCu, decrease in copper concentration in plant tissue, an increase in plant species richness and cover, an increase in rangeland grass cover, and a reduction in undesirable plant species (toxic, non-native). The results showed success in these factors except the study was not long enough to evaluate reduction in undesirable plant species (which increased in first five years). Tilling alone has demonstrated effectiveness on the site of improving grass cover in flat rocky soils (e.g. for ripped roads, see Section 5.3.3.3 in Appendix A). While natural attenuation rates for pCu have not been determined, tilling would likely increase the rate of attenuation. Copper present in surface soils would be tilled and mixed deeper into the soil along with bringing higher pH soils to the surface, attenuating the bioavailable copper concentration. Tilling also provides the benefit of breaking up the soil to allow plant growth. Tilling in relatively level locations was the most effective. Tilling was not tested on steeper slopes because of difficulty operating the equipment on steeper slopes. This alternative is not likely protective in steeper sloped areas or on bedrock, which account for 64 acres carried forward to evaluate for remediation. Tilling is most beneficial in flat rocky soils, where soil compaction is an issue preventing grass establishment.

Similar to Alternative 4, it is important to underscore the net environmental benefit of this remedial alternative. The plants are directly destroyed in the tilling, and the destruction of the plants "to benefit plants" and the potentially long recovery period required for the entire plant community to return to and potentially exceed pre-remediation habitat function in the semi-arid southwest (especially with possibly undesirable species establishing first) might outweigh the impact of effects of pCu on the vegetation community, depending on the pCu of the PELs. Protectiveness of the plants as a wildlife and livestock food source is an important criterion to consider in the FS, which may be lost until the community recovers from remediation. Any active remedy such as tilling of flat rocky soils would temporarily destroy the entire community, including both less sensitive species that are thriving and more sensitive species that would benefit in the long-term.

Site-specific data show that pCu has a significant effect on the plant community; however, there is some uncertainty in the degree of protection provided at the selected PELs versus PELs that incorporate the mean effects to both wildlife habitat and the less sensitive rangeland condition endpoint. Active remedy conducted at pCu between 4.6 and 4.98 for flat rocky soils (and between 3.83 and 4.4 for bedrock and between 2.97 and 4.11 for slope soils) may improve soil conditions for more sensitive species, but there may be a limited net benefit to wildlife habitat overall because all species are simultaneously affected by the action and the potential for effect from pCu in that range is uncertain. The number of acres identified for active remedy in flat rocky soils reduces 3-fold between PELs of 4.98 to 4.6 (Table 7-3). A lower PEL for flat rocky is technically justifiable as discussed in Section 7.3.1.1 and using a lower PEL (e.g., 4.6) would disturb less land and be more beneficial to the overall ecosystem. A lower PEL would be consistent with the phytotoxicity study and would incorporate effects on the soil structure due to grazing and land practices over time. Once the ecosystem re-establishes, Alternative 5 would meet the threshold criterion of overall protection of human health and the environment.

Compliance with ARARs

There are no chemical-specific ARARs for surface soil except for the pre-FS RAC. Action-specific and location-specific ARARs (Tables 2-2 and 2-3) would be met by remedial design. Alternative 5 may meet the threshold criterion of compliance with ARARs. The likelihood of achieving the desired pCu (≥ the PELs) is moderate with tilling but the likelihood of achieving a more diverse community with greater plant cover is high.

Long-term Effectiveness and Permanence

Long-term effectiveness and permanence is similar to Alternative 4. It is expected that pCu values would increase over time with mixing with deeper soils with lower copper and higher pH, that would result from tilling. Monitoring with soil sampling would be required to ensure that recontamination did not occur. As described above, tilling at pCu of < the soil-specific PELs would temporarily destroy the entire community, including both less sensitive and more sensitive species, and many species would not return potentially for an extended period of time. However, Alternative 5 would provide a high level of long-term effectiveness in the very long term and be permanent after species return.

Reduction of Toxicity, Mobility, or Volume

This alternative would mix the upper soil layers with underlying soils, decreasing copper concentrations and decreasing the amount of acidity in the soil. Toxicity in the soils would reduce. Mobility also may be reduced.

Short-term Effectiveness

This alternative would not be considered effective in the short-term. Mixing of surface soils with deeper soil layers resulting from tilling is expected to increase pH, decrease soil copper, and improve conditions for plant growth. However, it may take several years for the tilling to increase the pCu values. That said, as described above, tilling in flat rocky (only soil category that this technology would be effective in of the three categories being evaluated) would temporarily destroy the entire community, including both less sensitive and more sensitive species, and many species may not return for an extended period of time. When active remedy occurs at pCu < the PELs, the whole community is affected by the remedy. While there is some gain to improve soil conditions for more sensitive species, there is limited short-term effectiveness because all species are simultaneously affected.

Implementability

The implementability of this alternative is considered moderate. As with Alternative 3, tilling could not be used in areas of bedrock outcrops or steep slopes. Soil tilling can be achieved with standard equipment and materials. No extensive site preparation would be required.

Cost

The present value cost of this alternative is about $5.9 million (see Appendix F).

7.3.1.6 Alternative 6: Soil Amendments (Ferrihydrite), Tilling, and Monitoring

Protection of Human Health and the Environment

The ability of this alternative to satisfy this criterion is possibly similar to Alternative 4, but unlike lime, the effectiveness of ferrihydrite has not been tested on the site. Tilling has been shown to be effective on the site (e.g. for ripped roads, see Section 5.3.3.3 in Appendix A), as discussed above. Copper present in surface soils would be tilled and mixed deeper into the soil along with bringing higher pH soils to the surface. Tilling also provides the benefit of breaking up the soil to allow plant growth. The addition of ferrihydrite with tilling or in areas where tilling is impractical would be expected to decrease free cupric ion activity in soils and reduce the bioavailability of any remaining copper. Similar to Alternative 4, however, it is important to underscore the net environmental benefit of this remedial alternative. The plants are directly destroyed in the tilling, and the destruction of the plants “to benefit plants” and the potentially long recovery period required for the entire plant community to return to and potentially exceed pre-remediation habitat function in the semi-arid southwest might outweigh the impact of effects of pCu on the vegetation community, depending on the pCu of the PELs. Protectiveness of the plants as a food source for wildlife and livestock is an important criteria to consider in the FS, which may be lost until the community recovers from remediation. Any active remedy such as tilling of flat rocky soils would destroy the entire community, including both less sensitive species that are thriving and more sensitive species that would benefit in the long-term. The entire community may require a significant period of time to return to pre-remediation conditions.

Site-specific data show that pCu has a significant effect on the plant community; however, there is some uncertainty in the degree of protection provided at the selected PELs versus PELs that incorporate the mean effects to both wildlife habitat and the less sensitive rangeland condition endpoint. Active remedy conducted at pCu between 4.6 and 4.98 for flat rocky soils (and between 3.83 and 4.4 for bedrock and between 2.97 and 4.11 for slope soils) may improve soil conditions for more sensitive species, but there may be a limited net benefit to wildlife habitat overall because all species are simultaneously affected by the action and the potential for effect from pCu in that range is uncertain. The number of acres identified for active remedy in flat rocky soils reduces 3-fold between PELs of 4.98 to 4.6 (Table 7-3 above). A lower PEL for flat rocky is technically justifiable as discussed in Section 7.3.1.1 and using a lower PEL (e.g., 4.6) would disturb less land and might be more beneficial to the overall ecosystem. A lower PEL would be consistent with the phytotoxicity study and incorporate changes to the soil structure due to grazing and land practices over time. Once the ecosystem re-establishes, Alternative 6 would meet the threshold criterion of overall protection of human health and the environment.

Compliance with ARARs

There are no chemical-specific ARARs for surface soil, except for the pre-FS RAC, which might be met. Action-specific and location-specific ARARs (Tables 2-2 and 2-3) would be met by remedial design. The likelihood that Alternative 6 would meet the threshold criterion of compliance with ARARs is considered moderate for ferrihydrite alone and high if combined with tilling.

Long-term Effectiveness and Permanence

The long-term effectiveness of this alternative is considered moderate to high to increase pCu values. Ferrihydrite has been shown to reduce free cupric ion activity at similar sites and is less mobile than lime and thus may remain longer on steep slopes and be more effective than lime when used alone on steeper slopes. However, additional applications of soil amendments still may be required in bedrock outcrops or on steep slopes due to transportation of material from storm water flows. As described above, tilling at pCu of < 4.98 for flat rocky soils, < 4.4 for bedrock soils, and < 4.11 for bedrock soils would temporarily destroy the entire community, including both less sensitive and more sensitive species, and many species may not return for an extended period of time. Alternative 6 would provide a high level of long-term effectiveness and permanence only after species return. Because the beneficial effects of tilling in flat rocky soils (the soil type in which tilling is most effective) at pCu between 4.6 and the PEL (4.98) is uncertain, the long-term effectiveness of tilling in those areas with pCu between 4.6 and 4.98 may be lower than in the areas with pCu < 4.6 in flat rocky soils.

Reduction of Toxicity, Mobility, or Volume

This alternative would mix the upper soil layers with underlying soils, increasing pCu and thus reducing toxicity and amount of acid in the soils, plus adding ferrihydrite would reduce the bioavailability and mobility and thus toxicity of the copper.

Short-term Effectiveness

This alternative would not be considered effective in the short-term. Mixing of surface soils with deeper soil layers resulting from tilling with soil amendments is expected to increase pH, decrease soil copper, and improve conditions for plant growth. However, it may take several years for the soil amendments to increase the pCu values and the increase may be small if copper concentrations are high. As described above, tilling in areas at pCu of < PELs would temporarily destroy the entire community, including both less sensitive and more sensitive species, and many species may not return for an extended period of time. When active remedy occurs at < PELs, the whole community is affected by the remedy. While there is some gain to improve soil conditions for more sensitive species, there is limited short-term effectiveness because all species are simultaneously affected.

Implementability

The implementability of soil amendments is considered high. Like alternative 4, use of the ferrihydrite in this alternative means the treatment could be applied to areas with steep slopes and bedrock outcrop areas, which cannot be addressed by physical means. Additional applications of soil amendments may be required in the future in bedrock outcrops or steep slopes due to the transportation of amendments in storm water. Tilling is considered only moderately implementable as it could not be used in areas of bedrock outcrops or steep slopes but should be effective in flat rocky soils.

Cost

The present value cost of this alternative is $6.4 million (see Appendix F).

7.3.1.7 Alternative 7: Soil Cover and Monitoring

Protection of Human Health and the Environment

Soil cover would reduce but not eliminate plant contact with the contaminants. Also, the pathways would only be incomplete if the soil cover remains in place. The soil cover could be breached by digging, construction, or similar activities. This could potentially pose a risk to the vegetation. Most importantly, many plants have deep roots and would still access the contaminated soil beneath the cover, and those plants may have reduced uptake but still be exposed. It is important to also underscore the net environmental benefit of this remedial alternative. The plants are directly destroyed during the soil cover process. In soils with pCu between the selected PELs and the lower PELs identified when thresholds for rangeland wildlife habitat are averaged (the “uncertain” pCu range), the net environmental benefit may be lower than alternatives without destructive remediation, as soil cover destroys the entire community, including both less sensitive species that are thriving and more sensitive species that would benefit. The destruction of the plants “to benefit plants” and recovery period for an undetermined but possibly long time frame required for the entire plant community in the semi-arid southwest might outweigh the effect of the pCu on the plants in the uncertain pCu range. Protectiveness of the plants as a food source for wildlife and livestock is an important criterion to consider in the FS, which may be lost until the community recovers from remediation. Any active remedy such as implementing a soil cover would initially destroy the entire community, including both less sensitive and more sensitive species. When active remedy occurs in areas < PELs, the whole community is affected by the remedy. While there is some gain to improve soil conditions for more sensitive species, there may be limited net environmental gain overall for areas in the uncertain pCu range because all species are simultaneously destroyed when the cover is placed, whether in bedrock, steep slopes or on flat rocky soils. A lower PEL in flat rocky soils is more consistent with the phytotoxicity study and incorporates changes to the soil structure due to grazing and land practices over time. Covering bedrock and steep areas with soil in areas < PELs may not be effective enough to restore the community due to soil erosion, and may not be beneficial until pCu is at the lower end of the uncertain PEL range (and no areas have pCu below the lower alternative PELs for bedrock and slope soils). Once the ecosystem re-establishes, Alternative 7 would meet the threshold criterion of overall protection of human health and the environment.

Compliance with ARARs

There are no chemical-specific ARARs for surface soil except for the pre-FS RAC. Action-specific and location-specific ARARs (Tables 2-2 and 2-3) would be met by remedial design. Alternative 7 would meet the threshold criterion of compliance with ARARs.

Long-term Effectiveness and Permanence

A soil cover would require long-term operations, maintenance, and monitoring to continue to be effective. A soil cover would be considered a moderately effective solution. As described above, a soil cover placed in soils with pCu < soil-specific PELs would destroy the entire community, including both less sensitive and more sensitive species, and even with seeding, many species may not return for an unknown, but likely extended period of time. Because the beneficial effects of placing a soil cover at pCu between 4.6 and the PEL (4.98) for flat rocky soils and between 3.83 and the PEL (4.4) for bedrock and between 2.97 and the PEL (4.11) for slope soils is uncertain, the long-term effectiveness of cover placement in those areas with uncertain benefits may be lower than in the areas with pCu < the lower end of the pCu range (determined by means of the three vegetation endpoints)..Alternative 7 would provide a high level of long-term effectiveness and permanence after species return.

Reduction of Toxicity, Mobility, or Volume

This alternative would not meet the statutory preference for treatment. Alternative 7 does not reduce the toxicity, mobility, or volume because no treatment would be implemented; only contaminated soil would be covered.

Short-term Effectiveness

This alternative is not considered to be effective in the short-term. It would address all of the pCu areas < PELs, but, as described above, a soil cover placed over acres with pCu below the PELs would temporarily destroy the entire plant community, including both less sensitive and more sensitive species, and, even after seeding, many species may not return for an extended period of time. When active remedy occurs at the PELs, the whole community is affected by the remedy. While there is some gain to improve soil conditions for more sensitive species, there is no short-term effectiveness because all species are simultaneously affected. Vegetation in borrow areas would be adversely impacted in the short-term, too.

Implementability

This alternative is considered moderately implementable. Unlike excavation, placing a soil cover could be implementable in areas of bedrock outcrops but would be difficult in steep slopes, and might erode off of bedrock, also. Covering bedrock on 47 acres would require large amounts of soil and large borrow areas. Of the 377 acres addressed for pCu exposure, 14 acres are on steep slopes. More maintenance is required with this option than for other alternatives.

Cost

The present value cost of this alternative is $13.2 million (see Appendix F).

7.3.1.8 Alternative 8: Surface Soil Controls – Phytostabilization

Protection of Human Health and the Environment

The overall protection of this alternative would be low. Contaminant reduction from planting vegetation in order to contain contaminants within the soils and plant roots would not necessarily lower pCu in the area needing remediation nor help reduce toxicity to the plants, although it may reduce erosion and wind dispersion of contaminated soil to adjacent areas or into drainages. It is also important to underscore the net environmental benefit of this remedial alternative. The existing plants may be directly destroyed and replaced during the phytostabilization and planting process. The destruction of the plants “to benefit plants” and unknown but potentially long recovery period required for the native plant community to return in the semi-arid southwest likely outweighs the benefit of stabilizing the soil, because stabilization does not reduce phytotoxicity in the targeted area nor is it likely to increase pCu in the area stabilized. Protectiveness of the plants as a food source for wildlife and livestock is an important criterion to consider in the FS, which may be lost until the desired plants of the community that remediation is supposed to protect recover from the disruption from the remediation. Any active remedy such as implementing phytostabilization would temporarily disrupt the entire community, including both less sensitive and more sensitive species. While there is some gain to improve soil stability, there is no net environmental gain overall because existing species are disrupted during the planting and low pCu is not effectively addressed. Overall benefit is unlikely within the uncertain PEL range between the selected PEL and alternative lower PELs discussed in previous sections. The lower PEL for flat rocky is technically justifiable as discussed in Section 7.3.1.1 and using a low PEL (e.g., 4.6) would disturb less land and be more beneficial to the overall ecosystem. A lower PEL for bedrock and slope soils than the selected PELs is also justifiable because the benefit of soil stabilization, which is very minor for pCu, likely does not outweigh the temporary disruption to the plant community. Once the ecosystem re-establishes, Alternative 8 would still not meet the threshold criterion of overall protection of human health and the environment.

Compliance with ARARs

There are no chemical-specific ARARs for surface soil except for the pre-FS RAC. Action-specific and location-specific ARARs (Tables 2-2 and 2-3) would be met by remedial design, but Alternative 8 would not meet the threshold criterion of compliance with ARARs because it is unlikely to meet the pre-FS RAC.

Long-term Effectiveness and Permanence

The long-term effectiveness for this alternative is considered to be very low compared to the other alternatives. Phytostabilization has the potential to be effective at stabilizing the soils and reducing transport of impacted soils. However, this technology used alone would not be effective at reducing site contaminant levels and/or exposure to plants the remediation is supposed to protect.

Reduction of Toxicity, Mobility, or Volume

This alternative would not meet the statutory preference for treatment. Alternative 8 does not reduce the toxicity, mobility, or volume because no treatment would be implemented.

Short-term Effectiveness

This alternative would be considered not to be effective in the short-term because of the length of time required for the disrupted vegetation community to become re-established relative to an uncertain benefit in that the pCu onsite may not improve. Additionally, as described above, phytostabilization would destroy many species in the community and many species may not return for an extended period of time. When this active remedy occurs at < PELs, species insensitive and sensitive to pCu are affected by the planting of other species used for phytostabilization. While there is some gain to improve soil stability, there is no short-term effectiveness because the community is disrupted by the planting and remedial activities.

Implementability

Revegetating soils with species that are targeted at soil stabilization is generally considered implementable at the Site. There may be certain areas of the site that may not support the phytostabilization species (due to slopes, percent soil coverage, and soil conditions). Plant species and potential locations would be determined during the remedial design process.

Cost

The present value cost of this alternative is $6.6 Million (see Appendix F).

7.3.2 Comparative Analyses of Soil Alternatives - pCu

A comparison of soil alternatives for pCu is provided in Table 7-2. Although Alternatives 1 and 2 are the greenest of the remediation alternatives considered, they do not meet the threshold criteria because the acres do not meet the Pre-FS RAC for pCu and, therefore, do not meet the state's criteria for reduction of risk to vegetation. Chino carried forward for remedial consideration 377 acres associated with the estimated PELs of 4.98, 4.11, 4.11, and 4.40 for the flat rocky, slope, flat granular, and bedrock soil categories, respectively. Lower PELs by soil type could be technically justifiable, particularly for flat rocky soils. Lower PELs that average in effects of rangeland condition that can be technically justifiable are 4.6, 2.97, 2.97, and 3.83 for flat rocky, slope, flat granular, and bedrock soil categories, respectively. Of the 377 acres carried forward, the No Action or Monitoring alternative may be protective of human health and the environment in areas where remedial benefits are uncertain, which is between the selected PEL and the alternative lower PELs. In areas with pCu below the lower PELs, benefits of active remedy are more certain.

Alternative 2 would not satisfy the criteria of "overall protection"; however, due to the presence of naturally occurring calcium carbonate (which may occur in Gila conglomerate and other areas), natural attenuation may be occurring at some areas of the site because as wind and erosion occur, the calcium carbonate in dust particles can buffer the soil pH over time and increase pCu. The rate of natural attenuation is currently unknown but was enhanced by the 2008 white rain, which deposited lime on the soil that also buffers the soil pH. The long-term effectiveness of the monitoring alternative is dependent on the unknown natural attenuation rate in the future. Based on the amendment, pH and insect studies, the white rain in 2008 decreased cupric ion activity (increased pCu), reduced copper uptake into plants and thus reduced phytotoxicity, and improved plant richness. Without active remediation, improvements to low pCu soils beyond the improvement in 2008 from the white rain, however, are not anticipated in the short-term to meet the RAOs. Total estimated cost for Alternative 2 is $1.8 million.

Alternative 3, which is not considered to be a green remediation alternative, involves removal and monitoring of low pCu soils for areas indicated for remediation of pCu in Figure 8-1. This alternative would meet overall protection for ecological receptors and the targeted receptor of the plant community if measures are taken to ensure soil quality remaining is high by tilling if the soil is compacted and by seeding or by implementing other ways of improving the soil; however, excavation initially physically destroys habitat which must be restored (Redente 2004). The effectiveness of this remedial alternative in the long-term is high because it increases pCu values and, as long as the excavation leaves tilled, granular soils, should benefit the plant community. Once historically deposited soils are excavated, the source of the material would be removed; however, short term monitoring and sampling may be required to document that the excavation was sufficient. This alternative does not reduce toxicity, mobility, and volume of the concentration of pCu in surface soil because there is no treatment and this alternative is also not considered effective in the short-term because the remedy itself destroys the very receptor it aims to protect and though seeding can accelerate return, it will take an undetermined, but likely extended period of time to mature into the plant community that was lost. The implementability of this alternative is considered moderate compared to other alternatives. Total estimated cost is $11.1 million.

Alternative 4 is amendments (lime) coupled with tilling and monitoring of low pCu soils. This alternative would meet overall protection for vegetation. Amendments include lime but not organic matter. The long-term effectiveness of this alternative is considered moderate to high to increase pCu values. While lime (calcium carbonate) has been shown to increase pCu values at the site, Arcadis (2017) indicates that liming is recommended for soils with pH < 2 but liming is not that helpful above that pH, and soil pH identified herein are not less than pH 2. However, it is uncertain if liming would be ineffective at pH > 3 in other soils than used in the amendment study and tilling plus lime may be beneficial. Organic matter was not recommended after the amendment study was completed because cow manure brought in weedy plants that degraded the habitat; however, other forms of organic matter could be considered but are not because lime can be effective without it. This alternative is not effective in the short-term as it may take several years for the soil amendments to increase the pCu values and vegetation must re-establish when destroyed during tilling or damaged with lime slurry amendments sprayed on them, and it takes an undetermined but potentially extended period of time to return to a mature community. The tilling aspect of the remedy initially destroys the plant community. The long-term effectiveness of this alternative is considered moderate to high (is high in non-steep soils) for increasing pCu values but has been found to be most effective at improving the grass cover due to breaking up compacted soils. Toxicity would be decreased with increase in pCu. The implementability of tilling is high in flat rocky soils, but not implementable in bedrock and steep soils. Implementability of soil amendments is considered high compared to the other alternatives; however, additional applications may be required if steep slopes or bedrock are encountered that experience high storm water runoff. This alternative is considered to be a moderately green remediation alternative. Total estimated cost is $6.4 million.

Alternative 5, which is a moderately green remediation alternative, is tilling and monitoring of low pCu soils. This alternative would meet overall protection for vegetation. The ability of Alternative 4 to satisfy the criteria of “overall protection” is high in non-steep and non-bedrock areas that can be tilled. Tilling mixes cleaner soils with surface soils, reducing copper concentrations and can expose more of the soil to calcium carbonates at depth if calcium carbonates are present. The long-term effectiveness of this alternative is considered moderate for increasing pCu values but has been found to be most effective at improving the grass cover due to breaking up compacted soils. This alternative would decrease concentrations by mixing the topsoil layers with underlying soils, and mobility and toxicity may be reduced. That said, this remedy is not effective in the short term as tilling initially destroys the plant community. Implementability in flat rocky soils is better than Alternative 3 because less equipment and movement of soil are required but, because it does not include amendments, is not implementable in bedrock and steep soils. Total estimated cost is $5.8 million, which is roughly half the cost of Alternative 3.

Alternative 6 is amendments (ferrihydrite) coupled with tilling and monitoring of low pCu soils and this alternative would meet overall protection goals for vegetation. The amendment is ferrihydrite. The long-term effectiveness of this alternative is considered moderate to high to increase pCu values, as ferrihydrite has been shown to reduce cupric ion activity at similar sites. However, liming the soils (Alternative 4) would achieve similar results, is more readily available, and the dosing is easier to determine without the need for a pilot study, which ferrihydrite would require. Organic matter was not recommended after the amendment study was completed because cow manure brought in weedy plants that degraded the habitat; however, other forms of organic matter could be considered but lime in white rain has been found to be effective without organic matter added. Similar to lime amendments and tilling, this alternative with ferrihydrite and tilling would not be considered moderately effective in the short-term because it initially destroys the plant community, and the amendments can damage the community initially. The implementability of soil amendments is considered high compared to the other alternatives; additional applications may be required if steep slopes and bedrock are encountered. This alternative is considered to be a moderately green remediation alternative. Total estimated cost is $6.4 million.

Alternative 7 includes the installation of a soil cover to protect plants and monitoring of low pCu soils and the cover system. This alternative might meet overall protection for vegetation, but plants with deeper roots may still access the contaminated soils. The overall protection to plants of this alternative could be moderate as it protects shallower-rooted plants but not deep-rooted plants, but those deep-rooted plants may have more tolerance to the low pCu (uncertain). The cover also has the advantage of eliminating direct human and avian contact with the contaminants. The long-term effectiveness for this alternative for protecting plants is considered at most to be moderate, compared to the other alternatives. The toxicity and volume of the material would not decrease with the addition of a soil cover in the layers underneath the cover but exposure on the surface would be reduced and the mobility of the contaminants by either wind erosion, overland flow, or infiltration would be reduced. This alternative would not be considered effective in the short-term because the soil cover initially destroys the established plant community. This alternative is not a preferred treatment designed to reduce toxicity, mobility and volume. The implementability of this alternative is considered to be moderate but would require extensive borrow areas to bring in soil to cover bedrock areas, and the borrow areas would further destroy plant communities, reducing short-term effectiveness of protecting plants. Because of the resource and fuel use required for implementation, and because of the long-term cover maintenance requirements, this alternative is not considered to be a green option. Total estimated cost is $13.2 million, which is slightly more than Alternative 3.

Alternative 8 is the use of phytostabilization as a surface soil control. The long-term effectiveness for this alternative is considered to be low. This technology used alone would not be effective at reducing site contaminant levels and/or exposure to the plants onsite, nor would it be effective in the short term because the phytostabilization initially disrupts the established plant community and it also takes a recovery period to re-establish the ecosystem. This alternative is not a preferred treatment designed to reduce toxicity, mobility and volume. This alternative is considered to be implementable, though there may be areas around the site that would present difficulties (due to slopes, percent soil coverage, and soil conditions). Because of the limited resources and fuel use required for implementation, this alternative is considered a green option. Total estimated cost is $6.6 million.

The recommended remedial alternative is Alternative 5: tilling and monitoring of low pCu soils. Alternative 5 uses the mixing of deeper cleaner soils and natural alkalinity of the Gila Conglomerate occurring in some areas to restore low pCu soils, which the no action and monitoring alternatives do not do. Compared to active remediation alternatives, it involves a lower carbon footprint compared to alternatives relying on excavation and trucking in a soil cover. Tilling would increase pCu but most importantly break up the compacted soils in flat rocky areas that may have become impacted from pCu as well as grazing. Breaking up the soils with tilling or ripping has been demonstrated to improve the plant community, especially grasses, on haul roads without seeding (Appendix A). This alternative addresses the flat rocky soil acreage but does not address bedrock or steeper slopes where tilling cannot occur, but amendments (lime, organic matter) that are part of other alternatives have not been particularly effective in steeper slopes in the amendment study and may not be in bedrock when storm runoff occurs, either. The bedrock and slope soil polygons carried forward for remedial consideration are not recommended for active remediation at the selected PELs (4.4 and 4.11, respectively) because of expected limited effectiveness. Although amendments applied to bedrock and slope soils could be considered for acres less than the lower PELs discussed in section 7.3, which are more certain to provide net environmental benefit, no bedrock or slope areas are lower than the lower range PELs. Implementability of Alternative 5 is better than Alternative 3 (excavation) because less equipment and movement of soil are required. That said, there is no short-term effectiveness due to tilling causing disruption of the plant community, which must re-establish itself as a mature community, which may be an extended period of time; the balance between the harm from plant destruction and benefit from increased pCu to produce the most net benefit is likely at a lower pCu than the selected soil-specific PELs. NMED should evaluate the net environmental benefit when selecting the final PEL (e.g., from Table 7-3 or Table D-5 or Table D-7) to use in the ROD, as the selected PELs likely will do more harm than good. A flat rocky PEL area with pCu <

4.6 is more certain to provide environmental benefit if tilled. Total estimated cost of this preferred alternative at the PELs identified in Section 7.3 is $5.8 million, which is roughly half the cost of Alternative 3.

7.4 Evaluation of Surface Water Alternatives – Surface Water Drainages

7.4.1 Detailed Analyses of Surface Water Alternatives – Surface Water Drainages

This section presents a detailed analysis of the surface water drainage alternatives for each of the threshold and balancing criteria described in Section 7.1, above. The drainages evaluated for remediation include the pool habitat areas in Drainages A, non-ephemeral C1, ephemeral C2, D2, and D3, as discussed in Section 4.2.1[17] and indicated on Figure 8-1. Alluvial sections of the drainages lack pool habitat and are not included.

7.4.1.1 Alternative 1: No Action

Protection of Human Health and the Environment

The No Action alternative does not provide any additional form of overall protection of human health and the environment. However, current exposure for all but the D3 drainage on average likely is low and protective overall, because only a small percentage of the samples in the drainages had an HQ > 1 (14% of non-ephemeral C-1, 20% of ephemeral C-2, and 25% of D2), except Drainage A, which had 50% of the two locations sampled with HQ > 1. Also, HQ exceedances were often low (2 and at most 3), lower than in D3 with HQs of 5. Evaluation of stock tanks on Drainage A indicates that Drainage A has improved in the more recent years (HQ < 1 in 2010 and 2021) and may be meeting the pre-FS RAC. Recent attempts to re-sample key drainages have failed because all were dry, which also indicates impacts to the environment are small because pool habitat is limited in these areas (see pale yellow areas that have limited habitat in Figure 4-3), particularly in dry years. However, no action does not address the uncertainty of the current conditions, whereas monitoring would. The no action alternative, therefore, does not meet the RAOs.

Compliance with ARARs

Alternative 1 for Surface Water Drainages is not compliant with ARARs because it is no action and there are some exceedances of copper based on NMAC §20.6.4.808 – 809 that need to be addressed with monitoring or other actions. Copper is the focus because it is main driver of risk, having significantly higher HQs than cadmium and lead, the other COCs for the drainages.

Long-term Effectiveness and Permanence

Alternative 1 for Surface Water Drainages is not effective in the long-term or permanent because it is no action and there are some exceedances of NMAC §20.6.4.808 – 809 for copper. However, natural attenuation may be happening, but without monitoring to ascertain the rates, this alternative is not protective. This alternative has the benefit of preserving the existing upland vegetation and aquatic ecosystem, both of which would take decades to recover following the implementation of an active remedial alternative.

---

[17] Subwatershed E pool area is actually a stock tank and addressed in Section 7.5.

Reduction of Toxicity, Mobility, or Volume

Alternative 1 for Surface Water Drainages does not reduce toxicity, mobility or volume because it is the no action alternative and does not provide treatment.

Short-term Effectiveness

Alternative 1 for Surface Water Drainages is not effective in the short-term because it is no action and there are some exceedances of NMAC §20.6.4.808 – 809 and uncertainty about the effect of the exceedances on the biota in the habitat.

Implementability

Alternative 1 is implementable at the site, as no action is required.

Cost

There are no costs associated with this alternative.

7.4.1.2 Alternative 2: Monitoring

Protection of Human Health and the Environment

Alternative 2 does not provide any form of additional overall protection of human health and the environment because it only involves monitoring. However, current exposure for all but the D3 drainage on average is low and protective overall, because only a small percentage of the samples in the drainages had an HQ > 1 (14% of non-ephemeral C-1, 20% of ephemeral C-2, and 25% of D2), except Drainage A, which had 50% of the two locations sampled with HQ > 1. HQs were low (usually 2 and at most 3), lower than in D3, which had HQs of 5. Evaluation of stock tanks on Drainage A indicates that Drainage A has improved in the more recent years (HQ < 1 in 2010 and 2021) and may be meeting the pre-FS RAC. Recent attempts to re-sample key drainages have failed because all were dry, which also indicates impacts to the environment are small because pool habitat is limited in these areas (see pale yellow areas that have limited habitat in Figure 4-3), particularly in dry years. Therefore, monitoring may be protective because it provides more data to evaluate need for remediation and may trigger a remedial alternative over time.

Compliance with ARARs

The Monitoring alternative is not immediately compliant with ARARs or the pre-FS RAC for some point locations, but may be meeting it for drainages on average. Monitoring would allow for adaptability and may trigger remedial activities over time. In this case, the likelihood of compliance with ARARs is dependent on whether pre-FS RAC are met when evaluated across the drainages currently (appears true for all but D3, particularly in areas where pools are limited and gone in dry years) and dependent on the management of upstream sources, suspended sediment and dissolved metals concentrations, as well as overall water quality and attenuation rates.

Long-term Effectiveness and Permanence

The effectiveness of this remedial alternative in the long-term may be limited, as likelihood of reducing concentrations to below aquatic criteria standards depends on natural attenuation, which appears to be occurring or may have already occurred for all but Drainage D3. This alternative has the benefit of preserving the existing upland and riparian vegetation and aquatic ecosystem, both of which would take decades to recover following the implementation of an active remedial alternative, while climate change may be drying up the limited pool habitat.

Additionally, this alternative affords the opportunity to continue data collection and to take additional action if necessary.

Reduction of Toxicity, Mobility, or Volume

Alternative 2 for Surface Water Drainages does not reduce toxicity, mobility or volume because it does not involve any active remedy, similar to the no action alternative.

Short-term Effectiveness

Alternative 2 for Surface Water Drainages is not effective in the short-term because it takes no action other than monitoring, and there are some exceedances of NMAC §20.6.4.808 - 809. However, current conditions may be protective for all but Drainage D3. Monitoring in the short term of all the retained drainages may trigger an action if conditions warrant it.

Implementability

This remedy is implementable at the site with limited additional effort. Long-term monitoring would be required to show improvements in water quality in the surface water drainages.

Cost

The present value cost of this alternative is $313,000 (see Appendix F).

7.4.1.3 Alternative 3: Excavation and Monitoring

Protection of Human Health and the Environment

The ability of this alternative to meet the overall protection of water quality is moderate to high. The overall protection is based on the removal of historical sediments, but also a reduction of potential upstream contributors in the upland areas feeding the drainages. This alternative would destroy the existing upland and riparian vegetation and aquatic ecosystem initially, and the vegetation could take decades to recover following the implementation of an active remedial alternative. The pools are limited and dry in drier years, particularly in alluvial drainages (pale yellow areas in Figure 4-3), providing limited habitat. The trade-off of remediation benefits and loss of riparian vegetation supports this remedy only for Drainage D3 that has high HQs.

Compliance with ARARs

The likelihood of compliance with the ARARs on an ongoing basis is moderate to high with this alternative. There is the potential for reduced long-term effectiveness of this alternative if upstream contributions continue. Additional excavation may be required at a future time.

Long-term Effectiveness and Permanence

The effectiveness of this remedial alternative in the long-term is moderate to high to reduce concentrations to aquatic life standards. In recent efforts to re-sample, areas of concern were dry so long-term effectiveness at protecting aquatic biota could be low if frequently dry. Once excavation of historical sediments is complete, monitoring will be required to document that water quality criteria have been met. Long-term effectiveness of this alternative may be dependent on addressing upstream contributors (suspended sediments and storm water). This alternative will be most effective in Drainage D3 as the net environmental benefit in other areas with limited exceedances in the long-term may be limited.

Reduction of Toxicity, Mobility, or Volume

This alternative would not meet the statutory preference for treatment. Alternative 3 does not reduce the toxicity, mobility, or volume because no treatment would be implemented.

Short-term Effectiveness

This alternative is considered moderately effective in the short-term. Surface water quality may take some time to improve, as was seen on Tributary 2 in the Lampbright Investigation Unit (Golder 2016). Normal risks associated with nuisance dust, excavation hazards, noise and traffic will impact short-term effectiveness.

Implementability

In specific surface water drainages, this alternative will potentially be difficult to implement compared to other alternatives. Drainage D3 is heavily vegetated over bedrock and tightly confined by the surrounding cliffs, particularly in the upstream portions of the drainage. Because of this, it is unclear if an access road could be built to allow access for this type of remedy. Drainages A, D2, C1 and C2 are similarly vegetated, though less confined with less bedrock in many areas than Drainage D3 and may be implementable but will damage riparian vegetation and wildlife habitat that may take decades to recover. Additional permitting and coordination would also be required compared to other alternatives. For other lower-gradient drainages, the excavation of historical sediments is considered implementable. Some of the drainages may not be accessible to large equipment, due to steep slopes or tight access. However, overall, this alternative is implementable at the lower-gradient sites. Equipment and materials to complete the job are readily available.

Cost

The present value cost of this alternative is $1 million (see Appendix F). Note this cost does not include building an access road in the drainages to implement this remedy, as the steep and vegetated nature of the drainages requires survey and design information that is currently unavailable.

7.4.1.4 Alternative 4: Instream Removal of Suspended Sediments and Monitoring

Protection of Human Health and the Environment

The ability of this alternative to meet the overall protection of water quality is moderate to high. The overall protection is based on the installation of limestone sedimentation basins within the drainage channels that trap and remove sediments, thereby decreasing the amount and bioavailability of copper in surface water pools. Long-term monitoring is suggested for the implementation of this alternative.

Compliance with ARARs

The likelihood of compliance with the ARARs on an ongoing basis is high, and potentially higher than Alternative 3. There is the potential for reduced long-term effectiveness of this alternative if upstream contributions continue. Excavation should be anticipated within the sedimentation basins periodically over time The addition of limestone to treat bioavailability of copper increases the potential compliance with ARARs.

Long-term Effectiveness and Permanence

The effectiveness of this remedial alternative in the long-term is moderate to high to reduce concentrations to aquatic life standards. Once excavation of historical sediments in the installation location is complete and sedimentation basins are installed to collect suspended sediment, monitoring will be required to document that water quality criteria have been met. Overall long-term effectiveness will also depend on any additional potential upstream sources of contaminants and frequency of removing contaminated sediments from the basins. Chemical treatment of the surface with limestone would increase the potential effectiveness of this alternative compared to Alternative 3. Vegetation damage will be limited to sediment basin locations and the constructed road leading to the basins. This alternative will be most effective in Drainage D3 as the net environmental benefit in other areas with limited exceedances in the long-term may be small.

Reduction of Toxicity, Mobility, or Volume

This alternative addresses toxicity by reducing the bioavailability of copper due to the presence of limestone in the sedimentation basins. It also reduces the mobility of the contaminants by removing them from contact with surface water. The volume of material will be reduced with this alternative and it will also prevent potential contamination of surface water due to the presence of historical sediments.

Short-term Effectiveness

This alternative is considered moderately effective in the short-term. Surface water quality may take some time to improve, and building a road into these areas to install the sediment basins will destroy vegetation in the short-term. Normal risks will occur associated with nuisance dust, excavation hazards, noise, and traffic.

Implementability

In specific surface water drainages this alternative will be potentially difficult to implement compared to other alternatives. Drainage D3 is heavily vegetated and tightly confined by the surrounding cliffs, particularly in the upstream portions of the drainage. Because of this, it is unclear if an access road could be built to allow access for this type of remedy. Drainages D2, non-ephemeral C1 and C2 are similarly vegetated, though less confined with less bedrock in many areas than Drainage D3. Additional permitting and coordination would be required compared to other alternatives due to the excavation component. Specifically for the critical habitat transect, excavation may be omitted and only limestone sedimentation basins placed in the surface water drainages. For other drainages, the excavation of historical sediments is considered implementable. Some of the drainages may not be accessible to large equipment, due to steep slopes or tight access. These factors make the implementability of this alternative more challenging than other alternatives. Equipment and materials to complete the job are readily available.

Cost

The present value cost of this alternative is $2.8 million (see Appendix F). Note this cost does not include building an access road in the drainages to implement this remedy, as the steep and vegetated nature of the drainages requires survey and design information that is currently unavailable.

7.4.1.5 Alternative 5: Limestone Treatment and Monitoring

Protection of Human Health and the Environment

The ability of this alternative to meet the overall protection of water quality is moderate to high. The overall protection is based on the installation of limestone in low-lying, low-energy areas within the drainage channels, thereby decreasing the bioavailability of copper in surface water. Long-term monitoring is suggested for the implementation of this alternative.

Compliance with ARARs

The likelihood of compliance with the ARARs on an ongoing basis is moderate to high, as lime would be placed in the stream channels without excavation in areas where velocities are low. The limestone would decrease the bioavailability of copper and increase the potential compliance with ARARs.

Long-term Effectiveness and Permanence

The effectiveness of this remedial alternative in the long-term is moderate to reduce concentrations to aquatic life standards. This technology allows water to pass through the limestone but without the benefit of basins to increase the contact time with surface water, so effectiveness is moderate, not high. Similar to Alternative 4, overall long-term effectiveness will also depend on any additional potential upstream sources of contaminants. This alternative will be most effective in Drainage D3 as the net environmental benefit in other areas with limited exceedances in the long-term may be limited, especially given the limited habitat value in the drainages.

Reduction of Toxicity, Mobility, or Volume

This alternative addresses toxicity by reducing the bioavailability of copper due to the presence of limestone in the drainage channels.

Short-term Effectiveness

This alternative is considered moderately effective in the short-term. Surface water quality may take some time to improve. Normal risks associated with nuisance dust, excavation hazards, noise, and traffic. Vegetation damage is expected to be significant, as an access road would need to be placed along the entire length of the drainage to allow for limestone placement and periodic maintenance.

Implementability

In specific surface water drainages this alternative will be potentially difficult to implement compared to other alternatives. Drainage D3 is heavily vegetated and tightly confined by the surrounding cliffs, particularly in the upstream portions of the drainage. Because of this, it is unclear if an access road could be built to allow access for this type of remedy. Drainages D2, non-ephemeral C1 and C2 are similarly vegetated, though less confined with less bedrock in many areas than Drainage D3. Some of the drainages may not be accessible to large equipment, due to steep slopes or tight access, which would be required to place limestone in as much of the channel bottoms as possible. These factors make the implementability of this alternative more challenging than other alternatives. Equipment and materials to complete the job are readily available.

Cost

The present value cost of this alternative is $9.6 million (see Appendix F). Note this cost does not include building an access road in the drainages to implement this remedy, as the steep and vegetated nature of the drainages requires survey and design information that is currently unavailable.

7.4.1.6 Alternative 6: Sediment Control, Erosion Control, and Monitoring

Protection of Human Health and the Environment

The ability of this alternative to meet the overall protection of water quality is low to moderate. The overall protection of this alternative is based on the control of suspended sediments and potentially dissolved concentrations in storm water. This alternative does not address historical sediments. The addition of limestone as part of the BMPs to treat dissolved/bioavailable copper would increase the potential compliance with ARARs.

Compliance with ARARs

The ability of this alternative to comply with this criterion is low to moderate.

Long-term Effectiveness and Permanence

The long-term effectiveness of this alternative is low to moderate. A significant amount of maintenance and monitoring will be required to implement a large enough sediment and erosion control program across all of the drainages. Potential excavation and maintenance of the BMPs would be required on a regular basis to keep this alternative effective. This alternative would damage vegetation and wildlife habitat which would take decades to recover. This alternative will be most effective in Drainage D3 as the net environmental benefit in other areas with limited exceedances in the long-term may be limited, especially given the limited habitat value in the drainages.

Reduction of Toxicity, Mobility, or Volume

This alternative (without limestone treatment) would not meet the statutory preference for treatment. Alternative 6 does not reduce the toxicity, mobility, or volume because no treatment would be implemented. If limestone or other material is used, toxicity and volume of the constituents may be reduced. Mobility of the constituents may be reduced.

Short-term Effectiveness

This alternative would be low to moderately effective in the short-term for aquatic habitat but may damage upland habitat. This alternative does not address the presence of historical sediments in the drainages. This alternative would take time for water quality to improve.

Implementability

In specific surface water drainages, this alternative will be potentially difficult to implement compared to other alternatives. Drainage D3 is heavily vegetated and tightly confined by the surrounding cliffs, particularly in the upstream portions of the drainage. Because of this, it is unclear if an access road could be built to allow access for this type of remedy. Drainages D2, non-ephemeral C1 and C2 are similarly vegetated, though less confined with less bedrock in many areas than Drainage D3. Some of the drainages may not be accessible to large equipment, due to steep slopes or tight access. Equipment and materials to complete the job are readily available.

Cost

The present value cost of this alternative is $4.2 million (see Appendix F). Note this cost does not include building an access road in the drainages to implement this remedy, as the steep and vegetated nature of the drainages requires survey and design information that is currently unavailable.

7.4.2 Comparative Analyses of Surface Water Alternatives – Surface Water Drainages

As presented in Section 4, four drainages were determined to have concentrations of potential concern to aquatic life uses, including Drainage A, Drainages C1 (non-ephemeral only) and C2 (ephemeral), Drainage D2, and Drainage D3. It is therefore appropriate to evaluate remedial alternatives for these five drainages.

Drainage A

The surface water in Drainage A is ephemeral and it is thus appropriate to use the WER-based Acute HQ when evaluating surface water quality. As included on Table 4-5 (watershed-specific WER-adjusted acute HQ), surface water results for copper ranged between an HQ of 1 and 3 in 2010, which is relatively low. Further, HQs in samples collected from stock tanks in Drainage A have been low. Stock tank 60 has historically been less than or equal to 3, HQs in samples collected from stock tanks 15, 25, and 26 have historically been less than 2, and HQs in samples collected from stock tank 16 have been less than 1 since 2007 (Table 4-7). Stock tanks 15, 26, and 60 were removed as part of rangeland improvements completed between 2013 and 2022 (see Section 4.1.2), so current data for these tanks are unavailable. However, a water quality sample was collected from stock tank 16 in 2021 and the WER-based Acute HQ for copper was less than 1. As a result of the relatively low HQs historically measured in this drainage, and because the latest sample indicates the copper HQ is less than 1, the monitoring remedy (Alternative 2) included on Table 7-4 is the most appropriate remedy for this drainage that may be naturally attenuating. Alternative 2 is also the greenest remediation alternative for Drainage A behind no action.

Drainages C1 (Non-ephemeral)

The surface water in the area of potential concern in Drainage C1 is non-ephemeral, and it is thus appropriate to use the watershed-specific WER-based Chronic HQ when evaluating surface water quality in this drainage. As included on Table 4-6, surface water results for copper have ranged between an HQ of 1 and 2 since 2010. Because the watershed-specific WER adjusted copper chronic HQs are around 2 or below in this drainage, and because more aggressive remedies may involve damaging existing vegetation that is currently thriving in these drainage systems, the monitoring remedy (Alternative 2) included on Table 7-4 is the most appropriate remedy for these drainages. Alternative 2 is also the greenest remediation alternative for Drainage C1 behind no action.

Drainage C2 (Ephemeral)

The surface waters in areas of potential concern in Drainage C2 are ephemeral in downstream sections (Figure 4-3) and thus it is appropriate to use the watershed-based WER-based Acute HQ when evaluating surface water quality in this drainage. The ephemeral portion has not been sampled but is included to be conservative. Because the copper HQs are around 2 or below in this drainage, and because more aggressive remedies may involve damaging existing vegetation that is currently thriving in this drainage systems, the monitoring remedy (Alternative 2) included on Table 7-4 is the most appropriate remedy. Alternative 2 is also the greenest remediation alternative for Drainage C2 behind no action.

Drainage D2

The surface water in Drainage D2 is ephemeral, and it is thus appropriate to use the WER-based Acute HQ when evaluating surface water quality. As included on Table 4-5 (watershed-specific WER-adjusted acute HQ), surface water results for copper ranged between an HQ of 0.5 and 2 between 2010 and 2013. An HQ of 2 was observed in 2013, which is anomalously high when compared to the HQs measured in 2010 and 2011. More data are needed in this drainage to determine if HQs return to their pre-2013 levels. The monitoring remedy (Alternative 2) included on Table 7-4 is therefore the most appropriate remedy for this drainage, as it prevents prematurely implementing an active remedy based on one data point and allows for the collection of additional data and the flexibility to act in the future, if needed. Alternative 2 is also the greenest remediation alternative for Drainage A behind no action.

Drainage D3

The surface water in Drainages D3 is ephemeral and it is thus appropriate to use the WER-based Acute HQ when evaluating surface water quality in this drainage. As described in Section 4, one surface water drainage location in Drainage D3 exceeds the WER-based Acute HQ for copper (see Section 4.2.1). The HQ for this location is 5 (Table 4-5). The water quality results in this drainage support one of the active remedies included in Table 7-4. However, Drainage D3 is steep, heavily vegetated, and little access is available to implement an active remedy. In fact, access constraints have limited additional sample collection higher up in the drainage. A road would need to be constructed to access the upgradient portions of the drainage to implement the active remedies, and the steep walls confining the drainage and heavy vegetation make this technically impractical. As a result, the monitoring remedy (Alternative 2) included on Table 7-4 is the most appropriate remedy for this drainage. Alternative 2 is also the greenest remediation alternative for Drainage D3 behind no action.

The total estimated cost for implementing a monitoring remedy for Drainages A, C1, C2, and D3 is $313K.

7.5 Evaluation of Surface Water Alternatives – Stock Tanks

7.5.1 Detailed Analyses of Surface Water Alternatives – Stock Tanks

This section presents a detailed analysis of the surface water stock tank remediation alternatives for each of the threshold and balancing criteria described in Section 7.1, above. The stock tank evaluated for remediation includes stock tank 06, as discussed in Section 4.2.2 and indicated on Figure 8-1.

7.5.1.1 Alternative 1: No Action

Protection of Human Health and the Environment

The No Action alternative does not provide any additional form of overall protection of human health and the environment and does not currently meet the RAOs. However, current exposure at stock tank 06 likely is low and protective overall, because HQs have oscillated between 1 and 2 since 2007 and improvements were made in 2023 to the approximately 230-acre drainage basin feeding stock tank 06 to provide for stable stormwater conveyance to the tank inlet (see Section 4.1.2). Because of these improvements, it is expected that water quality will continue to improve in stock tank 06 with time and may eventually meet the pre-FS RAC and RAOs.

Compliance with ARARs

Alternative 1 for Surface Water Drainages is not compliant with ARARs because it is no action and there are some exceedances of copper based on NMAC §20.6.4.808 – 809 that need to be addressed with monitoring or other actions.

Long-term Effectiveness and Permanence

Alternative 1 for Stock Tanks is not effective in the long-term or permanent because it is no action and there are some exceedances of NMAC §20.6.4.808 – 809 for copper. However, natural attenuation may be happening, particularly following the 2023 rangeland improvements, but without monitoring to ascertain the rates, this alternative is not protective.

Reduction of Toxicity, Mobility, or Volume

Alternative 1 does not reduce toxicity, mobility or volume because it is the no action alternative and does not provide treatment.

Short-term Effectiveness

Alternative 1 is not effective in the short-term because it is no action and there are some exceedances of NMAC §20.6.4.808 - 809.

Implementability

Alternative 1 is implementable at the site, as no action is required.

Cost

There are no costs associated with this alternative.

7.5.1.2 Alternative 2: Monitoring

Protection of Human Health and the Environment

Alternative 2 does not provide any form of overall protection of human health and the environment because it only involves monitoring. However, current exposure at stock tank 06 likely is low and protective overall, because HQs have oscillated between 1 and 2 since 2007 and improvements were made in 2023 to the approximately 230-acre drainage basin feeding stock tank 06 to provide for stable stormwater conveyance to the tank inlet (see Section 4.1.2). Because of these improvements, it is expected that water quality will continue to improve in stock tank 06 with time.

Compliance with ARARs

The Monitoring alternative is not immediately compliant with ARARs and there are some exceedances of copper based on NMAC §20.6.4.808 – 809. However, monitoring allows for adaptability and may trigger remedial activities over time. In this case, the likelihood of compliance with ARARs is dependent on the management of upstream sources, suspended sediment and dissolve metals concentrations, as well as overall water quality.

Long-term Effectiveness and Permanence

This remedial alternative may be effective in the long-term for reducing concentrations to below aquatic life standards with natural attenuation after the rangeland improvements. This monitoring alternative may be effective enough to address long-term risks because upstream sources of contaminants are concurrently addressed with the rangeland improvements, which were conducted in 2023. Additionally, this alternative affords the opportunity to continue data collection and to take additional action if necessary.

Reduction of Toxicity, Mobility, or Volume

This alternative does not reduce toxicity, mobility or volume because it is the no action alternative and does not provide treatment.

Short-term Effectiveness

This alternative may be effective in the short term, despite some exceedances of NMAC §20.6.4.808 – 809. The rangeland improvements conducted in 2023 may have already improved water quality in the short term, but the monitoring program is needed to establish if this occurred.

Implementability

This remedy is implementable at the site with limited additional effort.

Cost

The present value cost of this alternative is $258,000 (see Appendix F).

7.5.1.3 Alternative 3: Excavation and Monitoring

Protection of Human Health and the Environment

Removal of historical sediments from stock tanks would address a major contributor to aquatic risk; however, there is still the potential for long-term risk to aquatic receptors due to upstream contribution from either suspended sediments or dissolved metals concentrations in surface water. Improvements were made in 2023 to the approximately 230-acre drainage basin feeding stock tank 06 to provide for stable stormwater conveyance to the tank inlet (see Section 4.1.2). Because of these improvements, it is expected that water quality will continue to improve in stock tank 06 with time with or without active remediation.

Compliance with ARARs

The likelihood of compliance with the ARARs on an ongoing basis is moderate to high with this alternative. There is the potential for reduced long-term effectiveness of this alternative if upstream contributions continue. Additional excavation may be required at a future time. If they do not continue, natural attenuation is expected.

Long-term Effectiveness and Permanence

The effectiveness of this remedial alternative to reduce concentrations to aquatic life standards in the long-term is moderate to high. Once excavation of historical sediments is complete, monitoring will be required to document that water quality criteria have been met. Long-term effectiveness of this alternative may be dependent on addressing upstream contributors (suspended sediments and storm water). This process may already be underway following the rangeland improvements conducted in 2023.

Reduction of Toxicity, Mobility, or Volume

This alternative would not meet the statutory preference for treatment. Alternative 6 does not reduce the toxicity, mobility, or volume because no treatment would be implemented.

Short-term Effectiveness

This alternative is considered effective in the short-term, and water quality may already be improving following the 2023 rangeland improvements. Normal risks associated with nuisance dust, excavation hazards, noise, and traffic. Coordination may need to be made to provide alternative water sources to tanks owners during construction.

Implementability

Based on the location of stock tank 06 and its accessibility, this alternative is implementable at the site. Equipment and materials to complete the job are readily available.

Cost

The present value cost of this alternative is $325,000 (see Appendix F).

7.5.2 Comparative Analyses of Surface Water Alternatives – Stock Tanks

As presented in Section 4, stock tank 06 was determined to have concentrations of potential concern to aquatic life uses, and it is thus appropriate to evaluate remedial alternatives for this tank. The WER-adjusted acute HQ for copper has been less than 2 since 2007 (Table 4-7). Additionally, the approximately 230-acre drainage basin feeding stock tank 06 has been improved to provide for stable stormwater conveyance to the tank inlet (see Section 4.1.2). Because of these improvements, it is expected that water quality will continue to improve in stock tank 06 with time. As a result, the monitoring remedy (Alternative 2) included on Table 7-5 is the most appropriate remedy for this stock tank, as it allows for adaptability during the monitoring process and the potential to act at a later time if HQs do not continue to decline. Alternative 2 is also the greenest remediation alternative of those considered for stock tank 06 behind no action. Total estimated cost is $258,000.

8. Final Acres for Remedial Actions or Monitoring

Figure 8-1 identifies the acres for remedial actions or monitoring recommended in Section 7 when flat rocky soil PEL is set at 4.98. Figure 8-2 identifies the acres for remedial actions or monitoring recommended in Section 7 when flat rocky soil PEL is set at 4.6, which may provide greater ecological benefit than the 4.98 PEL. As discussed in Section 7.3, none of the active remedies achieve short term effectiveness because they destroy plants in order to protect them and it takes decades for the ecosystem to re-establish. Given the uncertainties in the derivation of PELs and the impact of grazing on the reference and site locations, choosing a lower PEL will actually achieve greater ecological benefit. Moreover, the capital expenditure is nearly triple the cost for flat rocky at a PEL of 4.98 with less certain ecological benefit compared to a PEL of 4.6. None of the acres recommended for remedial actions or monitoring overlap the recent TP-7 windblown areas (Figure 8-1, 8-2) and thus are included in this FS.

In summary, for soil copper, 140 acres are recommended for monitoring. For soil pCu, 313 acres in flat rocky soils are recommended for tilling and monitoring when pCu PEL for flat rocky is 4.98, and 113 acres in flat rocky soils are recommended for tilling and monitoring when pCu PEL for flat rocky is 4.6. For surface water drainages, sections with pools that have aquatic habitat in Drainage A, C1 (non-ephemeral section), C2 (ephemeral section), D2, and D3 are recommended for monitoring. For stock tanks, stock tank 6 in the western drainage in Drainage E, which received rangeland improvements in 2023, is recommended for monitoring.

9. References

Arcadis. 2001. *Phase II RI Report for the Ecological IU*, Prepared for Chino Mines Company, Hurley, New Mexico. August.

Arcadis. 2006. Interim Removal Action for Smelter/Tailing Soil Investigation Unit Work Plan. Prepared for Chino Mines Company, Hurley, New Mexico.

Arcadis. 2008a. Amendment Study Work Plan, Smelter/Tailings Soils IU. Prepared for Chino Mines Company, Hurley, New Mexico. Rev 2.0, February.

Arcadis. 2008b. White Rain Technical Memorandum. Prepared for Chino Mines Company, Hurley, New Mexico.

Arcadis. 2009. Interim Removal Action for Smelter/ Tailing Soils Investigation Unit. Prepared for Chino Mines Company, Hurley, New Mexico ("Golf Course IRA")

Arcadis. 2010a. Terrestrial Invertebrate Copper Bioaccumulation and Bioavailability Study for Smelter/ Tailing Soils Investigation Unit. Prepared for Chino Mines Company, Hurley, New Mexico

Arcadis. 2010b. Soil pH Monitoring Work Plan for Smelter/Tailings Soil Investigation Unit. Chino Mines Company Administrative Order on Consent.

Arcadis. 2010c. Smelter/Tailing Soils Investigation Unit Technical Memorandum for Residential Risk Issues. July.

Arcadis. 2010d. Response to Gradient Comments dated August 16, 2010 RE: Technical Memorandum for Residential Risk Issues. August.

Arcadis. 2010e. Response to Gradient Comments during the call on August 23, 2010 RE: Technical Memorandum for Residential Risk Issues. August.

Arcadis. 2010f. Draft Work Plan: Sediment Leaching to Groundwater Evaluation in Support of Groundwater Quality Pre-Feasibility Study Remedial Action Criteria, STSIU, Chino Administrative Order on Consent. October 10.

Arcadis. 2011a. Administrative Order on Consent Feasibility Study Proposal. Smelter Tailings Soils Investigation Unit. Prepared for Chino Mines Company, Hurley, New Mexico. October.

Arcadis. 2011b. Groundwater Quality Pre-Feasibility Study Remedial Action Criteria for Drainage Sediments. Prepared for Chino Mines Company, Hurley, New Mexico. April

Arcadis. 2011c. Development of Site-Specific Copper Criteria Work Plan. April.

Arcadis. 2011d. Small ground feeding bird RAC. Memorandum to Phil Harrigan and Jerry Schoeppner, NMED from Anne Thatcher and Carolyn Meyer. January 25.

Arcadis. 2012. Application of the Hydrology Protocol to STSIU Drainages. October.

Arcadis. 2013a. Development of Site-Specific Copper Criteria Interim Report. Prepared for Chino Mines Company. Submitted to NMED. March.

Arcadis. 2013b. Revised Site-Specific Copper Toxicity Model Report. Prepared for Chino Mines Company. Submitted to NMED. October 2013.

Arcadis. 2014a. Work Plan: Smelter Tailing Soils Investigation Unit (STSIU) – Phytotoxicity and Vegetation Community Study. Prepared for Freeport0McMoRan Chino Mines Company. Administrative Order on Consent Smelter/Tailing Soils Investigation Unit, Vanadium, New Mexico. March 2014.

Arcadis. 2014b. Application of the Hydrology Protocol to STSIU Drainages. Chino Mines, Vanadium, New Mexico. October 2014.

Arcadis. 2014c. Vegetation Monitoring Report for “Golf Course” Interim Remedial Action, Smelter/Tailing Soils Investigation Unit. Freeport-McMoRan Chino Mines Company. Vanadium, New Mexico. May 2014.

Arcadis. 2017. Year 5 Monitoring Report for Smelter/Tailings Soils Investigation Unit Amendment Study Plots. November. (Appendix A of this report)

Arcadis. 2018. Phytotoxicity and Vegetation Community Study, Smelter Tailings Soils Investigation Unit. September. (Appendix C of this report)

Arcadis. 2021. B-Ranch Interim Removal Action for Smelter/ Tailing Soils Investigation Unit. Prepared for Chino Mines Company, Hurley, New Mexico, August.

Arcadis. 2023. Year 5 Report on pH Monitoring to Evaluate the Effect of the White Rain on the Smelter/Tailings Soils Investigation Unit. March. (Appendix B of this report).

Arcadis. 2024. Technical memorandum on pCu reference area visit and analysis. November 10. (Attachment A in Appendix D of this FS report)

Bestelmeyer, B.T., J.E. Herrick, D.A. Trujillo, and K.M. Havstad. 2004. Land management in the American southwest: a state-and-transition approach to ecosystem complexity. Environmental Management 34:38-51.

Casmalia Resources Site Steering Committee. 2011. Casmalia site remediation project: Final remedial investigation report (Appendix U, Attachment 4). Available online: https://www.waterboards.ca.gov/rwqcb3/water_issues/programs/stormwater/docs/lid/Casmalia_Superfund_Site/Remedial%20Investigation%20Report/Appendix%20U/Attachments/Attachment%20U-4%20(Spatial%20EPCs)/Attachment%20U-4%20(Spatial%20EPCs)_Final_Jan2011.pdf.

Chino. 1995. Administrative Order on Consent, Investigation Area, Remedial Investigation Background Report, Chino Mines Company, Prepared by Chino Mines Company, Hurley, New Mexico, October 5.

Chino, 2018. *Freeport-McMoRan Chino Mines Company–Updated Closure Closeout Plan. Submittal Letter from Thomas L. Shelley (Chino) to Bruce Yurdin (NMED) and Fernando Martinez (MMD).* Bayard, New Mexico. February 18, 2018: Freeport-McMoRan Chino Mines Company.

Chino, 2024. *Freeport-McMoRan Chino Mines Company–Application to Renew Closure Closeout Plan, Discharge Permit 1340.* Bayard, New Mexico. October 30, 2024: Freeport-McMoRan Chino Mines Company.

Golder, 2018. *Chino Mine Closure/Closeout Plan Update,* Albuquerque, New Mexico: Golder Associates, Inc. February 14, 2018.

Telesto, 2024. *Chino Mine Closure/Closeout Plan Update,* Loveland, Colorado: Telesto Solutions, Inc. October 30, 2024.

DBS&A. 1999. Comprehensive Vegetation Survey of the Chino Mine, Grant County, New Mexico."

EMC2. 2014. Construction Quality Assurance Report, Lake One Reclamation, Chino Mines Company, Hurley, New Mexico. September 19.

Golder. 1999a. Phase I Remedial Investigation Proposal, Hanover and Whitewater Creeks Investigation Unit, May.

Golder. 1999b. *Comprehensive Groundwater Characterization Study, Phase 3 Report*, January.

Golder. 2000a. Administrative Order on Consent, Phase II Revised Remedial Investigation Report, Hurley Soils Investigation Unit, March 27.

Golder. 2000b. Administrative Order on Consent, Phase I Revised Remedial Investigation Report, Hanover/Whitewater Creek Investigation Unit, May.

Golder. 2006. Interim Remedial Action for Hurley Soils IU. Prepared on Behalf of Chino Mines Company.

Golder. 2007. Chino Mines Company, Chino Slag Pile, Characterization Study Report and Closure Plan for Discharge Permit 1340, Condition 89, August 29.

Golder. 2008. Hurley Soils Investigation Unit (HSIU) Interim Remedial Action Completion Report. Chino Mines Company Administrative Order on Consent.

Golder. 2013a. Chino Mines Tailing Pond 1 & 2 Construction Quality Assurance Report, Chino Tailing Reclamation Project, Chino Mine. August.

Golder. 2013b. Tailing Pond B/C Construction Quality Assurance Report, Chino Tailing Reclamation Project, Chino Mine. June.

Golder. 2013c. Supplemental Completion Report, Interim Removal Action, Smelter/Tailing Soils Investigation Unit. May 28 ("Railroad IRA").

Golder. 2013d. Chino Mines Tailing Dam No. 6 File Number D-508 Construction Quality Assurance Report, Chino Tailing Reclamation Project, Chino Mine. June.

Golder. 2015. Supplemental Completion Report, Razorback Ridge Area, Interim Remedial Action, Smelter/Tailings Soils Investigation Unit. August

Golder. 2016. Draft Chino Site-Wide Stage 1 Abatement Plan, Revised Final Investigation Report. Prepared on behalf of Chino Mines. August.

Golder. 2018. Vegetation Monitoring Report, Hurley Railroad Interim Remedial Action, Smelter/Tailings Soils Investigation Unit. October.

Golder. 2024. Assessment Report for Apache Tejo Wash, Smelter/Tailing Soil Investigation Unit. In Production.

Gradient. 2008. Chino Mines Administrative Order on Consent, STSIU Human Health Risk Assessment, July.

Harfenist, A., T. Power, K.L. Clark, and D.B. Peakall. 1989. A review and evaluation of the amphibian toxicological literature. Can. Widl. Serv. Tech. Rep. Ser. No. 61, Ottawa. 222 pp.

Long, E.R., Field, L.J., MacDonald, D.D. 1998. Predicting toxicity in marine sediments with numerical sediment quality guidelines. Environ Toxicol Chem 17:714-727.

Nagy, K.A. 2001. Food requirements of wild animals: predictive equations for free-living mammals, reptiles, and birds. Nutrition Abstracts and Reviews, Series B, 71, 21R-31R.

Natural Resources Conservation Service (NRCS). 1983. Soil Survey of Grant County, New Mexico, Central and Southern Parts. Available online at: Soil Survey of Grant County, New Mexico, Central and Southern Parts: United States. Natural Resources Conservation Service: Free Download, Borrow, and Streaming : Internet Archive.

NewFields. 2006a. Chino Mines Administrative Order on Consent, Site-Wide Ecological Risk Assessment, February.

NewFields. 2006b. Memo to Chris Eustice and Phil Harrigan, NMED from Mark Lewis, Joe Allen and Brian Hansen, NewFields Boulder re: Discussion Draft of Ecological Remedial Action Objectives for Chino Mines Site. September 8.

NewFields. 2008. Chino Mines Administrative Order on Consent, STSIU Ecological Risk Assessment, April.

NMDOT. 2021. US 180 Corridor Study, Bayard to Deming, CN1100840, Public Meeting Notice. September.

NMED. 1994. Administrative Order on Consent, Chino Mines Company. December 23.

NMED. 2010a. Letter to Mr. Timothy Eastep, Chino Mines Company, from Mr. Mr. Ron Curry, NMED re: Pre-Feasibility Study Remedial Action Criteria (Pre-FS RAC) Smelter and Tailings Soils Investigation Unit (S/TSIU), Chino Administrative Order on Consent (AOC). September 16

NMED. 2010b. Letter to Mr. Timothy Eastep, Chino Mines Company, from Mr. Phil Harrigan, NMED re: .Approval of Work Plan: Sediment Leaching to Groundwater Evaluation in Support of Groundwater Quality Pre-Feasibility Study Remedial Action Criteria, STSIU, Chino Administrative Order on Consent. November 8.

NMED. 2011a. Letter to Mr. Ned Hall from Mr. Bill Olsen Regarding Resolution of Information Dispute Resolution. March 3.

NMED. 2011b. Letter to Mr. Timothy Eastep, Chino Mines Company, from Mr. Phil Harrigan, NMED re: Groundwater Quality Pre-Feasibility Study Remedial Action Criteria for Drainage Sediments Report, STSIU, Chino Administrative Order on Consent. May 9.

Redente, Edward. 2004. Letter to Mr. Chris Eustice Regarding Upland and Ephemeral Habitat at Chino Mines. January 9.

Schafer and Associates. 1999a. Chino Administrative Order of Consent - Sitewide Ecological Risk Assessment Technical Memorandum No. 1: ERA Workplan. CMC Agreement No. C59938.

Schafer and Associates. 1999b. Chino Administrative Order of Consent - Sitewide Ecological Risk Assessment Technical Memorandum No. 2: ERA Sampling and Analysis Data Needs. CMC Agreement No. C59938.

SRK. 2004. Administrative Order on Consent Remedial Investigation Proposal for the Smelter/Tailing Soils Investigation Unit. July.

SRK. 2008a. Administrative Order on Consent Remedial Investigation Report for the Smelter/Tailing Soils Investigation Unit, Revision 2. February 2.

SRK. 2008b. Addendum to Administrative Order on Consent Revised Remedial Investigation Report for the Smelter/Tailing Soils Investigation Unit. June 25.

USEPA. 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA. OSWER Directive 9355.3-01, Office of Emergency Response and Remedial Response, Washington, D.C., October.

USEPA. 1994. Interim Guidance on Determination and Use of Water-Effect Ratios for Metals. EPA-B-94-001. U.S. Environmental Protection Agency, Washington, DC.

USEPA. 2001. Streamlined Water-Effect Ratio Procedure for Discharges of Copper. EPA-822-R-01-005. U.S. Environmental Protection Agency, Washington, D.C.

USEPA. 2012. Institutional Controls: A Guide to Planning, Implementing, Maintaining, and Enforcing Institutional Controls at Contaminated Sites. Office of Solid Waste and Emergency Response (OSWER) 9355.0-89, EPA-540-R-09-001, December.

Woodward Clyde. 1997. Sitewide Ecological Investigation Unit Remedial Investigation Work Plan. Chino Mines Company Administrative Order on Consent.

Tables

TABLE 2-1
CHEMICAL-SPECIFIC POTENTIALLY APPLICABLE STANDARDS FOR THE STSIU

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILING SOILS IU FEASIBILITY STUDY

Regulatory Program/Authority	Citation	Medium of Potential Interest	Notes
Safe Drinking Water Act (SDWA), Federal	40 CFR 141 Subpart F	Groundwater, Surface Water	Establishes primary drinking standards for public water systems.
SDWA, Federal	40 CFR 143, Subpart B	Groundwater, Surface Water	Establishes secondary non-enforceable health goals for public water systems at levels resulting in no known or anticipated adverse health effects.
Clean Air Act, Federal	40 CFR 50	Air	Establishes primary and secondary ambient air quality standards.
Clean Air Act, Federal	40 CFR 60	Air	Establishes (referenced by NMED AQCR 652) performance standards for new sources based on the specific source categories defined in the regulation.
Air Quality Control Act, State	20.2.3 NMAC	Air	Establishes ambient air quality standards.
Air Quality Control Act, State	20.2.78 NMAC	Air	Defines emissions standards for hazardous air pollutants.
New Mexico Water Quality Act	20.6.2.7.VV NMAC	Groundwater, Surface Water	Definition of a toxic pollutant.
New Mexico Water Quality Act	20.6.2.3101 NMAC	Groundwater	Designates groundwater with total dissolved solids<=10,000 mg/L as potential source of drinking water.
New Mexico Water Quality Act	20.6.4 NMAC	Surface Water	Provides water quality standards for human contact of surface waters. Defines water quality standards for livestock watering. This statute includes an anti-degradation policy, general water quality standards, primary contact standards, and wildlife standards.
New Mexico Water Quality Act	20.6.2.3103(A) NMAC	Groundwater	Establish human health standards for groundwater quality.
New Mexico Water Quality Act	20.6.2.3103(B) NMAC	Groundwater	Establishes additional standards for domestic water supplies.
New Mexico Water Quality Act	20.6.2.3103(C) NMAC	Groundwater	Establishes groundwater quality standards for irrigation use.
Resource Conservation and Recovery Act (RCRA), Federal	40 CFR 261.24	Soil	Regulates the determination of hazardous wastes by defining the maximum concentrations of listed contaminants as measured using the Toxicity Characteristic Leaching Procedure (TCLP).
CERCLA	40 CFR 300 Title 1, Section 101, 111	All Media	References the National Oil and Hazardous Substances Contingency Plan. Establishes funding and provisions for cleanup at hazardous waste sites.

TABLE 2-2
ACTION-SPECIFIC POTENTIALLY APPLICABLE STANDARDS FOR THE STSIU

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILING SOILS IU FEASIBILITY STUDY

Regulatory Program/Authority	Citation	Medium of Potential Interest	Description
CERCLA	40 CFR 300 Title 1, Section 101, 111	All Media	References the National Oil and Hazardous Substances Contingency Plan. Establishes funding and provisions for cleanup at hazardous waste sites.
SARA	42 USC 9601	All Media	Establishes clean-up standards and response actions, including the ARAR process (i.e. Applicable Standards).
Clean Water Act - National Pollution Discharge Elimination System (NPDES)	40 CFR 122 40 CFR 125	Surface Water	Requires permits for discharging pollutants from any point source into waters, lists hazardous substances and water-quality parameters, and defines the criteria and standards for issuances of permits, determining compliance, and granting variances. Establishes Best Management Practices (BMPs) to prevent releases of toxic constituents to surface waters.
Clean Water Act	40 CFR 230 40 CFR 231 Sec 404	Surface Water	Requires permits for discharging dredged or fill materials into the navigable waters, including wetlands or floodplains. Permits (Sec 404) are issued if the state has authorization, otherwise, Nation Wide Permits (NWPs) can be issued by the US Army, Corps of Engineers. Applies to all stream modifications, including underground and surface mining activities.
Rivers and Harbors Act of 1899	33 CFR 320 33 CFR 330	Surface Water	Regulates disposal/discharge of dredged or fill materials into US waters, including intermittent streams.
RCRA	40 CFR 241	Soil	Specifies performance requirements for land disposal of wastes.
RCRA	40 CFR 261	Soil	Defines criteria for identifying and classifying hazardous wastes.
RCRA	40 CFR 262	Soil	Establishes standards for generators of hazardous wastes, including requirements for waste shipment packaging, labeling, and manifests. Requirements may be applicable if remediation activities are performed at the S/TSIU and waste generated are hazardous.
RCRA	40 CFR 263	Soil	Establishes standards for transporters of hazardous wastes.
RCRA	40 CFR 264	Soil	Establishes standards for owner and operators of facilities for the treatment, storage, and disposal of hazardous wastes.
RCRA	40 CFR 268	All Media	Establishes treatment standards for hazardous constituents, identifies wastes that are restricted from land disposal and defines the limited circumstances under which they may be land disposed.
Department of Transportation (DOT) Regulations	49 CFR 173, 178, 179	Soil	Establishes requirements for packaging and shipment of hazardous waste.
CERCLA Off-Site Response Policy	OSWER 9634.11	All Media	Defines criteria for qualifying an off-site hazardous waste disposal facility.
Clean Air Act	42 USC Sections 7401 et. seq.	Air	Requires formulation of air quality standards and source performance standards.

TABLE 2-2
ACTION-SPECIFIC POTENTIALLY APPLICABLE STANDARDS FOR THE STSIU

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILING SOILS IU FEASIBILITY STUDY

Regulatory Program/Authority	Citation	Medium of Potential Interest	Description
New Mexico Hazardous Waste Act (NMHWA) NMED Hazardous Waste Bureau (HWB)	NMSA 1978, Sections 74-4-1 through 74-4-14	Hazardous Waste	Regulates treatment, storage, and disposal of hazardous waste to ensure maintenance to the quality of the state's environment.
NMHWA, NMED HWB	20.4.1.200 NMAC	Hazardous Waste	Defines criteria for identifying and classifying hazardous waste.
NMHWA, NMED HWB	20.4.1.300 NMAC	Hazardous Waste	Defines standards applicable to generators of hazardous wastes for packaging, labeling, and manifesting waste for transport.
NMHWA, NMED HWB	20.4.2.400 NMAC	Hazardous Waste	Defines standards applicable to the transportation of hazardous waste.
NMHWA, NMED HWB	20.4.1.900 NMAC	Hazardous Waste	Identifies hazardous wastes which are restricted from land disposal.
New Mexico Solid Waste Management Regulations	20.9.1 NMAC	Solid Waste	Regulates the permitting, design, location, and operation of solid waste disposal facilities.
New Mexico Water Quality Act (NMWQA)	NMSA 1978, Sections 74-6-1 through 74-6-17	Groundwater, Surface Water	Bans non-permitted discharge of any water contaminant.
NMWQA	20 NMAC 6.2, Section 1-201	Groundwater, Surface Water	Requires that NMED be notified of any discharge which could affect surface water or groundwater quality.
NMWQA	20 NMAC 6.2, Section 3-104	Groundwater	Discharge plan may be required for any discharge affecting groundwater quality.
NMWQA	20 NMAC 6.2, Section 4-103	Groundwater, Surface Water	Abatement standards and requirements for the vadose zone, groundwater and surface water.
Occupational Safety and Health Act (OSHA)	29 CFR 1910, 1926, 1954	All Media	These standards establish safety requirements for hazardous waste operations and sets exposure limits of chemicals.
RCRA	42 USC Sections 8901 et. seq.	Hazardous Waste	Regulates treatment, storage, and disposal of hazardous waste and encourages resource conservation and recycling.

TABLE 2-3
LOCATION-SPECIFIC POTENTIALLY APPLICABLE STANDARDS FOR THE STSIU

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILING SOILS IU FEASIBILITY STUDY

Regulatory Program/Authority	Citation	Medium of Potential Interest	Notes
National Historic Preservation Act	36 CFR 63	Historic, Archaeological	Establishes procedures for determining a property's eligibility for inclusion in the National Register of Historic Places.
National Historic Preservation Act	36 CFR 800	Historic, Archaeological	Requires that federal agencies consider the effects of actions on historic properties and archaeological resources.
National Historic Preservation Act of 1979	36 CFR 296 43 CFR 7	Historic, Archaeological	Establishes procedures to be followed by federal land managers in providing protection for archaeological resources.
Standards and Guidelines for Archaeology and Historic Preservation	48 CRF 44716	Archaeological	Provides guidelines for conducting archaeological surveys.
American Indian Religious Freedom Act of 1978	42 USC 1996	Cultural	Requires consultation with local tribes if a project could effect ceremonial, religious, or burial sites.
American Indian Graves Freedom and Reparation Act	25 USC 3001 through 25 USC 3013	Cultural	Requires that project activities cease if Native American graves are discovered.
Migratory Bird Treaty Act	50 CFR 10, 21	Wildlife	Prohibits pursuit, hunting, taking, capture, possession, or killing of all migratory birds or their nests or eggs.
Bald and Golden Eagle Protection Act	50 CFR 10, 22	Wildlife	Prohibits taking or killing of bald and golden eagles.
Endangered Species Act of 1973	40 CFR 17 and 50 CFR 402	Plant, Wildlife	Requires that actions do not jeopardize endangered species or adversely modify their critical habitat, and establishes the process for consulting with the US Fish and Wildlife Service.
Fish and Wildlife Coordination Act	40 CFR 6.302g	Surface Water	Requires that federal agencies be consulted prior to modifying any stream so that wildlife will be protected.
Endangered Species Act	16 USC 1531	Wildlife	Protects endangered species and restricts activities within their habitat.
Resource Conservation and Recovery Act (RCRA)	40 CFR 241.202	All Media	Establishes standards for sitting RCRA solid-waste disposal facilities.
Fish and Wildlife Coordination Act	40 CFR 6.302	Rivers	Protects wildlife habitats and prevents the modification of streams or rivers that effect fish or wildlife.

TABLE 2-3
LOCATION-SPECIFIC POTENTIALLY APPLICABLE STANDARDS FOR THE STSIU

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILING SOILS IU FEASIBILITY STUDY

Regulatory Program/Authority	Citation	Medium of Potential Interest	Notes
Executive Order, 11990	40 CFR 6 Appendix A	Wetlands	Protects wetlands and regulates activities conducted in a wetland area in order to minimize potential destruction, loss or degradation of the wetlands.
Clean Water Act	40 CFR 230 33 CFR 320-330	Wetlands	Prohibits filling of wetlands and prohibits the discharge dredged or filled material to a wetland without a permit.
Executive Order, 11988	40 CFR 6 Appendix A	Floodplains	Restricts the types of activities that can be conducted within a floodplain to minimize harm and preserve natural values.
New Mexico Cultural Properties Act	NMSA 18.6	Historic, Archaeological	Requires identification of cultural resources, assessment of potential effects, and consultation with the State Historic Preservation Officer.
New Mexico Wildlife Conservation Act, and New Mexico Endangered Plant Act	NMSA 17-2-27 through NMSA 17-2-46	Plant, Wildlife	Establishes the State's authority to conduct an investigation for the purpose of identifying endangered and threatened species and developing (if necessary) an appropriate management plan for ensuring the protection of such species.
New Mexico Prehistoric and Historic Sites and Preservation Act	NMSA 1978, Sections 18-8-1 through 18-8-8	Historic, Archaeological	Requires identification of historic resources, assessment of potential impacts, and consultation with State Historic Preservation Office.
National Environmental Policy Act	42 USC Section 4331 et. seq.	Ecosystems	Policy to encourage harmony between humans and the environment to minimize environmental damages and support health and welfare. The Act encourages coordination and cooperation between government agencies in planning and conduction of any action that will affect the government.
National Environmental Policy Act	40 CFR Part 6	Ecosystems	Procedures requiring integration of all applicable federal laws and executive orders into the environment review process mandated under the Act.

TABLE 3-1
SUMMARY OF SURFACE SOIL ARSENIC AND IRON RESULTS

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILING SOILS IU FEASIBILITY STUDY

Sample Location:	Pre-FS RAC	Units	S1	S2	S3	S4	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20
Sample Depth (inch):			0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1
Date Collected:			11/06/04	11/06/04	11/06/04	11/06/04	10/28/04	11/06/04	10/29/04	11/06/04	10/27/04	10/28/04	10/28/04	10/29/04	10/29/04	11/06/04	10/27/04	10/27/04	10/30/04	10/27/04
Metals																				
Arsenic	27	mg/kg	3.70 J	1.80 J	3.50 J	1.60 J		4.30 J	5.00 J	3.00 J	3.40 J	2.50 J	6.40 J	5.60 J	6.80 J	4.50 J	3.60 J	3.60 J	5.00 J	3.50 J
Iron	100,000	mg/kg	13,100	9,630	15,300	45,500		21,200	16,800	13,900	17,100	17,000	21,000	19,100	24,000	17,100	20,100	16,500	19,300	18,000

Location ID:	Pre-FS RAC	Units	S21	S22	S23	S24		S28	S29	S30	S31	S32	S33	S34	S35	S36	S37	S38	S39	S40
Sample Depth(Inches):			0 - 1	0 - 1	0 - 1	0 - 1		0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1
Date Collected:			10/27/04	10/30/04	10/28/04	10/28/04		10/30/04	10/31/04	10/28/04	10/30/04	10/29/04	10/29/04	10/29/04	11/07/04	11/10/04	11/07/04	11/07/04	11/11/04	11/11/04
Metals																				
Arsenic	27	mg/kg	3.30 J	6.30 J	2.60 J	2.80 J		2.90 J	1.40 J	1.10 J	2.50 J	2.70 J	2.60 J	2.80 J	4.80 J	4.70 J	5.10 J	5.90 J	6.50 J	9.40 J
Iron	100,000	mg/kg	20,500	19,800	17,000	17,100		16,000	18,100	14,500	13,900	15,300	14,500	17,900	18,200	21,100	19,900	19,000	18,900	24,500

Location ID:	Pre-FS RAC	Units	S41	S42	S43	S44		S48	S49	S50	S51	S52	S53	S54	S55	S56	S57	S58	S59	S60
Sample Depth(Inches):			0 - 1	0 - 1	0 - 1	0 - 1		0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1
Date Collected:			11/07/04	11/08/04	11/11/04	11/11/04		11/11/04	11/07/04	11/08/04	11/09/04	11/11/04	11/07/04	11/08/04	11/09/04	11/09/04	11/08/04	11/08/04	10/30/04	10/30/04
Metals																				
Arsenic	27	mg/kg	6.20 UJ	6.30 J	3.70 J	0.980 J		7.30 J	10.3 J	1.80 J	5.20 J	3.70 J	15.1 J	7.30 J	4.50 J	3.10 J	3.50 J	3.90 J	18.9 J	21.8 J
Iron	100,000	mg/kg	33,600	25,100	12,800	7,170		21,000	41,000	13,900	25,500	14,300	45,700	34,800	24,200	18,600	34,600	32,700	62,400	58,600

Location ID:	Pre-FS RAC	Units	S61	S62	S63	SS97		SS101	SS102	SS103	SS104	SS105	SS106	SS107	SS108	SS109	SS110	SS111	SS112	SS113
Sample Depth(Inches):			0 - 1	0 - 1	0 - 1	0 - 1		0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1
Date Collected:			10/31/04	10/31/04	10/31/04	07/24/06		07/12/06	07/12/06	07/24/06	07/22/06	07/20/06	07/22/06	07/19/06	07/17/06	07/20/06	07/22/06	07/19/06	07/19/06	07/17/06
Metals																				
Arsenic	27	mg/kg	25.4 J	16.0 J	9.40 J	3.90		2.20	2.20	2.40	2.10	2.00	2.10	0.980	1.40	1.90	2.90	2.30	2.20	1.80
Iron	100,000	mg/kg	34,600	35,500	24,600	29,400		55,000	34,200	12,300	10,300	30,200	10,500	7,360 J	32,300	23,600	24,700	12,100 J	14,500 J	14,200

Location ID:	Pre-FS RAC	Units	SS114	SS115	SS116	SS117		SS121	SS122	SS123	SS124S	SS125S	SS126	SS127	SS128	SS129S	SS130	SS131S	SS132	SS133
Sample Depth(Inches):			0 - 1	0 - 1	0 - 1	0 - 1		0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1
Date Collected:			07/17/06	07/23/06	07/22/06	07/20/06		07/11/06	07/18/06	07/13/06	07/19/06	07/19/06	07/22/06	07/20/06	07/20/06	07/19/06	07/21/06	07/18/06	07/24/06	07/22/06
Metals																				
Arsenic	27	mg/kg	1.80	3.10	3.60	5.40		3.20	0.760	2.00	2.70	1.30	2.00	1.90	1.80	2.10	1.50	1.80	2.90	2.50
Iron	100,000	mg/kg	31,800	24,200	34,400	31,100 J		21,400 J	10,600 J	14,300	26,700 J	12,300 J	19,000	27,700 J	31,800 J	26,000 J	21,200	17,500 J	26,200	23,300

Location ID:	Pre-FS RAC	Units	SS134	SS135	SS136	SS137		SS141	SS142	SS143	SS144	SS145	SS146	SS147	SS148	SS149	SS150	SS151	SS152	SS153
Sample Depth(Inches):			0 - 1	0 - 1	0 - 1	0 - 1		0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1
Date Collected:			07/21/06	07/21/06	07/22/06	07/21/06		07/23/06	07/21/06	07/24/06	07/22/06	07/23/06	07/23/06	07/22/06	07/18/06	07/24/06	07/24/06	07/15/06	07/15/06	07/15/06
Metals																				
Arsenic	27	mg/kg	2.20	2.10	2.30	2.30		1.90	3.20	2.20	4.20	3.40	2.70	2.00	3.80	2.70	2.60	2.30	1.20	2.50
Iron	100,000	mg/kg	47,200	36,400	25,200	62,000	26,600	55,600	53,500	29,200	30,800	141,000	64,300	24,700	123,000 J	46,500	24,600	19,700	24,100	24,200

TABLE 3-1
SUMMARY OF SURFACE SOIL ARSENIC AND IRON RESULTS

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILING SOILS IU FEASIBILITY STUDY

Location ID: Sample Depth(Inches): Date Collected:	Pre-FS RAC	Units	SS154 0 - 1 07/16/06	SS155 0 - 1 07/16/06	SS156 0 - 1 07/13/06	SS157 0 - 1 07/15/06	SS160 0 - 1 07/16/06	SS161D 0 - 1 07/16/06	SS162D 0 - 1 07/11/06	SS163D 0 - 1 07/11/06	SS164D 0 - 1 07/14/06	SS165D 0 - 1 07/14/06
Metals												
Arsenic	27	mg/kg	0.0400 U	1.80	2.10	1.70	0.95	2.2	1.9	0.92	1.9	1.8
Iron	100,000	mg/kg	24,400	23,300	28,600	20,100	18,400	18,800	16,200	12,700	9,460	10,600

The following data were collected for the RI but were not used in the FS because the sampling locations overlapped interim action locations:

Location ID: Sample Depth(Inches): Date Collected:	Pre-FS RAC	Units	S64 0 - 1 11/05/04	S65 0 - 1 11/05/04	S66 0 - 1 11/05/04	S67 0 - 1 11/05/04	S70 0 - 1 11/05/04	S71 0 - 1 11/05/04	S72 0 - 1 11/04/04	S73 0 - 1 11/05/04	S74 0 - 1 11/01/04	S75 0 - 1 11/01/04	S76 0 - 1 11/01/04	S77 0 - 1 11/01/04	S78 0 - 1 11/04/04	S79 0 - 1 11/04/04	S80 0 - 1 11/10/04	S81 0 - 1 11/10/04	S82 0 - 1 11/10/04	S83 0 - 1 11/12/04
Metals																				
Arsenic	27	mg/kg	4.1 J	2.3	1.2	2.4 J	2.2	3.3 J	2.3	2.1	1.6	1.7	2.6	1.3	1.5	1.4	1.1 J	2.5 J	2.2 J	1.9
Iron	100,000	mg/kg	25,100	16,200	20,400	27,400	19,100	15,000	9,670	12,900	9,780	15,800	11,700	9,710	10,900	11,100	17,200	20,300	12,600	11,400

Location ID: Sample Depth(Inches): Date Collected:	Pre-FS RAC	Units	S84 0 - 1 11/10/04	S85 0 - 1 11/10/04	S86 0 - 1 11/17/04	S87 0 - 1 11/12/04	S90 0 - 1 11/17/04	S91 0 - 1 11/17/04	S92 0 - 1 11/17/04	S93 0 - 1 11/17/04	S94 0 - 1 11/12/04	S95 0 - 1 11/12/04	S96 0 - 1 11/17/04
Metals													
Arsenic	27	mg/kg	0.45 J	1.4 J	2.4	1.4	2.6	1.8	2.2	2.5	1.1	2.6	2.1
Iron	100,000	mg/kg	14,600	18,500	16,200	9,290	14,800	23,646	36,300	15,300	18,500	8,650	15,800

Notes:
Shaded values exceed the Pre-FS RAC
mg/kg = milligram per kilogram

TABLE 3-2
STSIU Surface Soil Copper Results Adjusted to 0-6"

STSIU Feasibility Study
Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Location ID	Alternate ID	Source Report	Year Collected	Original Soil depth	Sieving Status	1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]	Northing (State Plane)	Easting (State Plane)	Latitude	Longitude	Copper Concentration[1] To Compare to HH Pre-FS RAC (250 µm sieve)	Copper Concentration[1] For Bird Pre-FS RAC Analysis (2000 µm sieve)	Pre-Interim Remedial Action (IRA) Dataset	Removed in Post-IRA Dataset	Reason Removed (also see this column's footnotes)
2001	U01-2001	AOC Background Report, Chino 1995	1995	0-1"	not sieved		654870.780	2658493.164	32.8000800	-108.0435680	170	153	Y		
2002	U01-2002	AOC Background Report, Chino 1995	1995	0-1"	not sieved		655267.029	2662705.501	32.8011920	-108.0298610	186	167	Y		
2003	U01-2003	AOC Background Report, Chino 1995	1995	0-1"	not sieved		653325.700	2663627.527	32.7958600	-108.0268490	294	265	Y		
2004	U01-2004	AOC Background Report, Chino 1995	1995	0-1"	not sieved		654017.898	2662957.483	32.7977590	-108.0290340	172	155	Y		
2005	U01-2005	AOC Background Report, Chino 1995	1995	0-1"	not sieved		651650.919	2663754.729	32.7912580	-108.0264250	152	137	Y		
2006	U01-2006	AOC Background Report, Chino 1995	1995	0-1"	not sieved		650524.991	2663945.050	32.7881640	-108.0257990	150	135	Y		
2007	U01-2007	AOC Background Report, Chino 1995	1995	0-1"	not sieved		648773.724	2663880.215	32.7833500	-108.0260000	88	79	Y		
2008	U01-2008	AOC Background Report, Chino 1995	1995	0-1"	not sieved		648770.670	2663878.888	32.7833410	-108.0260040	214	193	Y		
2009	U01-2009	AOC Background Report, Chino 1995	1995	0-1"	not sieved		647572.619	2658250.339	32.7800190	-108.0443110	204	184	Y		
2010	U01-2010	AOC Background Report, Chino 1995	1995	0-1"	not sieved		652691.986	2664215.321	32.7941210	-108.0249330	199	179	Y		
2011	U01-2011	AOC Background Report, Chino 1995	1995	0-1"	not sieved		651473.461	2664692.260	32.7907740	-108.0233730	146	131	Y		
2012	U01-2012	AOC Background Report, Chino 1995	1995	0-1"	not sieved		654758.873	2664398.604	32.7998030	-108.0243480	69	62	Y		
ERA01		Ecological Risk Assessment, Newfields 2005	2005	0-6"	2 mm sieve[2]		617972.009	2636736.996	32.6985210	-108.1140540	--	3517	Y	Removed*	Borrow Area
ERA02		Ecological Risk Assessment, Newfields 2005	2005	0-6"	2 mm sieve[2]		614507.011	2639087.005	32.6890130	-108.1063860	--	811	Y		
ERA03		Ecological Risk Assessment, Newfields 2005	2005	0-6"	2 mm sieve[2]		613062.009	2639598.997	32.6850450	-108.1047090	--	709	Y		
ERA04		Ecological Risk Assessment, Newfields 2005	2005	0-6"	2 mm sieve[2]		614512.998	2643462.001	32.6890600	-108.0921650	--	541	Y		
ERA05		Ecological Risk Assessment, Newfields 2005	2005	0-6"	2 mm sieve[2]		614547.014	2643776.013	32.6891550	-108.0911450	--	399	Y		
ERA06		Ecological Risk Assessment, Newfields 2005	2005	0-6"	2 mm sieve[2]		618149.006	2642362.985	32.6990470	-108.0957670	--	499	Y		
ERA07		Ecological Risk Assessment, Newfields 2005	2005	0-6"	2 mm sieve[2]		609705.992	2641096.999	32.6758310	-108.0998130	--	789	Y		
ERA08		Ecological Risk Assessment, Newfields 2005	2005	0-6"	2 mm sieve[2]		609384.014	2640076.006	32.6749390	-108.1031290	--	710	Y	Removed*	WBT
ERA09		Ecological Risk Assessment, Newfields 2005	2005	0-6"	2 mm sieve[2]		613515.982	2649386.984	32.6863580	-108.0728990	--	562	Y		
ERA10		Ecological Risk Assessment, Newfields 2005	2005	0-6"	2 mm sieve[2]		612552.990	2651319.997	32.6837230	-108.0666090	--	485	Y		
ERA11		Ecological Risk Assessment, Newfields 2005	2005	0-6"	2 mm sieve[2]		602716.010	2653028.991	32.6566940	-108.0609860	--	276	Y		
ERA12		Ecological Risk Assessment, Newfields 2005	2005	0-6"	2 mm sieve[2]		598790.994	2652202.999	32.6459010	-108.0636420	--	204	Y		
ERA13		Ecological Risk Assessment, Newfields 2005	2005	0-6"	2 mm sieve[2]		612107.011	2656763.010	32.6825280	-108.0489150	--	126	Y		
ERA14		Ecological Risk Assessment, Newfields 2005	2005	0-6"	2 mm sieve[2]		597769.017	2635249.992	32.6429780	-108.1187110	--	109	Y		
ERA15		Ecological Risk Assessment, Newfields 2005	2005	0-6"	2 mm sieve[2]		620786.999	2628575.003	32.7061960	-108.1406130	--	712	Y		
ERA16		Ecological Risk Assessment, Newfields 2005	2005	0-6"	2 mm sieve[2]		586145.006	2611137.001	32.6108260	-108.1969190	--	77	Y	Removed	Outside vegetation alliance polygon extent
ERA17		Ecological Risk Assessment, Newfields 2005	2005	0-6"	2 mm sieve[2]		586974.009	2612631.012	32.6131180	-108.1920760	--	57	Y	Removed	Outside vegetation alliance polygon extent
ERA18		Ecological Risk Assessment, Newfields 2005	2005	0-6"	2 mm sieve[2]		587334.995	2614268.015	32.6141260	-108.1867630	--	73	Y	Removed	Outside vegetation alliance polygon extent
ERA19		Ecological Risk Assessment, Newfields 2005	2005	0-6"	2 mm sieve[2]		585563.983	2615159.986	32.6092660	-108.1838470	--	62	Y	Removed	Outside vegetation alliance polygon extent
ERA20		Ecological Risk Assessment, Newfields 2005	2005	0-6"	2 mm sieve[2]		585436.991	2614671.006	32.6089120	-108.1854340	--	45	Y	Removed	Outside vegetation alliance polygon extent
ERA21		Ecological Risk Assessment, Newfields 2005	2005	0-6"	2 mm sieve[2]		585099.986	2614047.987	32.6079800	-108.1874540	--	48	Y	Removed	Outside vegetation alliance polygon extent
ERA22		Ecological Risk Assessment, Newfields 2005	2005	0-6"	2 mm sieve[2]		623082.014	2634381.997	32.7125490	-108.1217550	--	1120	Y		
ERA23		Ecological Risk Assessment, Newfields 2005	2005	0-6"	2 mm sieve[2]		613644.990	2641016.992	32.6866570	-108.1001050	--	973	Y	Removed*	Operations Reclamation Occurred
ERA24		Ecological Risk Assessment, Newfields 2005	2005	0-6"	2 mm sieve[2]		614747.989	2651501.014	32.6897570	-108.0660370	--	63	Y		
ERA25		Ecological Risk Assessment, Newfields 2005	2005	0-6"	2 mm sieve[2]		608598.000	2657629.986	32.6728880	-108.0460750	--	70	Y		
ERA26		Ecological Risk Assessment, Newfields 2005	2005	0-6"	2 mm sieve[2]		610167.015	2641490.005	32.6771010	-108.0985400	--	535	Y		
ERA27		Ecological Risk Assessment, Newfields 2005	2005	0-6"	2 mm sieve[2]		588758.017	2645253.986	32.6182800	-108.0861410	--	328	Y		
ERA28		Ecological Risk Assessment, Newfields 2005	2005	0-6"	2 mm sieve[2]		635693.009	2631937.010	32.7471930	-108.1298190	--	1060	Y		
ERA29		Ecological Risk Assessment, Newfields 2005	2005	0-6"	2 mm sieve[2]		653750.990	2641025.006	32.7968940	-108.1004080	--	460	Y		
ERA30		Ecological Risk Assessment, Newfields 2005	2005	0-6"	2 mm sieve[2]		647315.000	2665089.007	32.7793460	-108.0220580	--	102	Y		
ERA31		Ecological Risk Assessment, Newfields 2005	2005	0-6"	2 mm sieve[2]		574691.984	2657662.001	32.5796910	-108.0457500	--	78	Y	Removed	Outside vegetation alliance polygon extent
ERA32		Ecological Risk Assessment, Newfields 2005	2005	0-6"	2 mm sieve[2]		646513.995	2638816.000	32.7769870	-108.1075360	--	419	Y		
ERA33		Ecological Risk Assessment, Newfields 2005	2005	0-6"	2 mm sieve[2]		642325.997	2636187.009	32.7654570	-108.1160530	--	176	Y		

Footnotes:
[1]PreFS RAC for copper for small ground feeding bird applies to 0-6" soil sieved to < 2 mm (2000 µm). Pre-FS RAC for human health applies to 0-1" soil sieved to < 0.25 mm (250 µm). The ratio used to convert copper concentration of 0-1" sieved at <0.25 mm soils to 0-6" sieved at < 2 mm soils is from Appendix A (median ratio of SS samples) of Arcadis (2011). Multiplied copper concentration by 0.7 if outside windblown tailings (and by 1.5 if inside windblown tailings). If unsieved, multiplied by 0.9 if outside windblown tailings and by 1.3 if inside windblown tailings. The 0.9 and 1.3 are from median ratios of unsieved 0-1" soil in 2009 lab reports (at 25 m on transect) compared to sieved 0-6" co-located soil in Drexler lab report in Appendix D of the pH Monitoring Report (Appendix B to the FS Report) for soils in and outside of windblown tailings, respectively (FID 8, 18, 20 in tailings). A subset of the data collected using x-ray fluorescence as part of the Railroad Interim Removal Action (Golder 2013) was collected at 0-2 inch" and sieved at <0.25 mm; the same ratios described here were applied to these data to estimate 0 to 6 inch bgs.
[2]Data were collected for ecological endpoint and were not corrected to human health values.
[3]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as IRA.
[4]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as HWY 180.
[5]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as 2:1 slope.
[6]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as Volcanic Rock.
[7]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as NMDOT.
[8]If two samples were collected from the same location in the same sampling year (with identical sample location coordinates), an average was used in place of the two parent samples. For the co-located samples U04-1121 (SRK 2008) and FID 18 (Arcadis 2009), samples were collected in different years, and the sample from the more recent year was used (FID 18).
*Removed samples with the asterisk are set to 327 for the Theissens analysis. All other removed samples are completely voided.
-- means no data available at the location.

TABLE 3-2
STSIU Surface Soil Copper Results Adjusted to 0-6"

STSIU Feasibility Study
Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Location ID	Alternate ID	Source Report	Year Collected	Original Soil depth	Sieving Status	1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]	Northing (State Plane)	Easting (State Plane)	Latitude	Longitude	Copper Concentration[1] To Compare to HH Pre-FS RAC (250 µm sieve)	Copper Concentration[1] For Bird Pre-FS RAC Analysis (2000 µm sieve)	Pre-Interim Remedial Action (IRA) Dataset	Removed in Post-IRA Dataset	Reason Removed (also see this column's footnotes)
ERA34		Ecological Risk Assessment, Newfields 2005	2005	0-6"	2 mm sieve[2]		646629.005	2662757.994	32.7774490	-108.0296380	--	57	Y		
FID 0		Five Year pH Monitoring Report, Arcadis 2017a	2009	0-6"	2 mm sieve[2]		616828.811	2626577.181	32.6953000	-108.1470700	--	329	Y		
FID 1		Five Year pH Monitoring Report, Arcadis 2017a	2009	0-6"	2 mm sieve[2]		625332.452	2664225.021	32.7189200	-108.0247400	--	143	Y		
FID 10		Five Year pH Monitoring Report, Arcadis 2017a	2009	0-6"	2 mm sieve[2]		620561.989	2636911.369	32.7056410	-108.1135090	--	1020	Y		
FID 101		Five Year pH Monitoring Report, Arcadis 2017a	2009, 2010, 2014	0-6"	2 mm sieve[2]		608735.664	2643808.296	32.6731820	-108.0909940	--	285	Y		
FID 102		Five Year pH Monitoring Report, Arcadis 2017a	2009, 2010, 2014	0-6"	2 mm sieve[2]		604799.633	2644505.322	32.6623680	-108.0886980	--	287	Y		
FID 103		Five Year pH Monitoring Report, Arcadis 2017a	2009, 2010	0-6"	2 mm sieve[2]		602216.563	2644915.336	32.6552710	-108.0873460	--	317	Y	Removed*	IRA
FID 104		Five Year pH Monitoring Report, Arcadis 2017a	2009, 2010	0-6"	2 mm sieve[2]		605612.285	2642797.984	32.6645900	-108.0942520	--	454	Y	Removed*	IRA
FID 105		Five Year pH Monitoring Report, Arcadis 2017a	2009, 2010, 2014	0-6"	2 mm sieve[2]		613881.307	2640031.508	32.6873000	-108.1033110	--	1230	Y		
FID 106		Five Year pH Monitoring Report, Arcadis 2017a	2009, 2010, 2014	0-6"	2 mm sieve[2]		608565.372	2652441.935	32.6727690	-108.0629350	--	450	Y		
FID 12		Five Year pH Monitoring Report, Arcadis 2017a	2009	0-6"	2 mm sieve[2]		616897.123	2637286.041	32.6955700	-108.1122600	--	4260	Y	Removed*	IRA
FID 13		Five Year pH Monitoring Report, Arcadis 2017a	2009	0-6"	2 mm sieve[2]		617045.390	2637627.900	32.6959800	-108.1111500	--	1970	Y		
FID 15		Five Year pH Monitoring Report, Arcadis 2017a	2009, 2010, 2014	0-6"	2 mm sieve[2]		617713.596	2638949.138	32.6978260	-108.1068610	--	1360	Y		
FID 16		Five Year pH Monitoring Report, Arcadis 2017a	2009, 2010, 2014	0-6"	2 mm sieve[2]		617063.361	2638873.938	32.6960380	-108.1071000	--	512	Y		
FID 17		Five Year pH Monitoring Report, Arcadis 2017a	2009	0-6"	2 mm sieve[2]		617710.785	2636903.713	32.6978040	-108.1135100	--	4680	Y	Removed*	IRA
FID 18		Five Year pH Monitoring Report, Arcadis 2017a	2009, 2010, 2014	0-6"	2 mm sieve[2]		609040.575	2643554.287	32.6740190	-108.0918220	--	326	Y		
FID 2		Five Year pH Monitoring Report, Arcadis 2017a	2009	0-6"	2 mm sieve[2]		618469.103	2656648.402	32.7000150	-108.0493300	--	405	Y		
FID 20		Five Year pH Monitoring Report, Arcadis 2017a	2009	0-6"	2 mm sieve[2]		612866.109	2640078.306	32.6845100	-108.1031500	--	790	Y		
FID 21		Five Year pH Monitoring Report, Arcadis 2017a	2009	0-6"	2 mm sieve[2]		613697.651	2649267.161	32.6868560	-108.0732900	--	131	Y		
FID 22		Five Year pH Monitoring Report, Arcadis 2017a	2009, 2010, 2014	0-6"	2 mm sieve[2]		606434.501	2647809.707	32.6668830	-108.0779730	--	285	Y		
FID 23		Five Year pH Monitoring Report, Arcadis 2017a	2009	0-6"	2 mm sieve[2]		602770.491	2645930.926	32.6568000	-108.0840500	--	252	Y	Removed*	Borrow Area (WBT)
FID 24		Five Year pH Monitoring Report, Arcadis 2017a	2009	0-6"	2 mm sieve[2]		578535.998	2656367.001	32.5902500	-108.0499800	--	121	Y	Removed	Outside vegetation alliance polygon extent
FID 25		Five Year pH Monitoring Report, Arcadis 2017a	2009	0-6"	2 mm sieve[2]		581913.504	2652250.313	32.5995100	-108.0633700	--	66	Y	Removed	Outside vegetation alliance polygon extent
FID 26		Five Year pH Monitoring Report, Arcadis 2017a	2009	0-6"	2 mm sieve[2]		577926.834	2657160.390	32.5885800	-108.0474000	--	75	Y	Removed	Outside vegetation alliance polygon extent
FID 27		Five Year pH Monitoring Report, Arcadis 2017a	2009	0-6"	2 mm sieve[2]		630414.800	2631251.479	32.7326800	-108.1320000	--	206	Y	Removed	Outside vegetation alliance polygon extent
FID 28		Five Year pH Monitoring Report, Arcadis 2017a	2009, 2010, 2014	0-6"	2 mm sieve[2]		607544.515	2656084.395	32.6699840	-108.0510910	--	348	Y		
FID 3		Five Year pH Monitoring Report, Arcadis 2017a	2009	0-6"	2 mm sieve[2]		599371.963	2636002.644	32.6473900	-108.1162800	--	236	Y		
FID 30		Five Year pH Monitoring Report, Arcadis 2017a	2009	0-6"	2 mm sieve[2]		614771.262	2626020.397	32.6896400	-108.1488600	--	90	Y		
FID 31		Five Year pH Monitoring Report, Arcadis 2017a	2009	0-6"	2 mm sieve[2]		586152.892	2651782.210	32.6111600	-108.0649200	--	187	Y	Removed	Outside vegetation alliance polygon extent
FID 32		Five Year pH Monitoring Report, Arcadis 2017a	2009	0-6"	2 mm sieve[2]		622947.567	2626795.207	32.7121200	-108.1464200	--	2120	Y		
FID 33		Five Year pH Monitoring Report, Arcadis 2017a	2009	0-6"	2 mm sieve[2]		597385.177	2649476.540	32.6420200	-108.0724900	--	308	Y		
FID 34		Five Year pH Monitoring Report, Arcadis 2017a	2009	0-6"	2 mm sieve[2]		620256.499	2623972.714	32.7047000	-108.1555700	--	209	Y		
FID 35		Five Year pH Monitoring Report, Arcadis 2017a	2009	0-6"	2 mm sieve[2]		617751.360	2659913.875	32.6980600	-108.0387100	--	210	Y		
FID 37		Five Year pH Monitoring Report, Arcadis 2017a	2009, 2010, 2014	0-6"	2 mm sieve[2]		620831.901	2642490.509	32.7064220	-108.0953740	--	805	Y		
FID 39		Five Year pH Monitoring Report, Arcadis 2017a	2009	0-6"	2 mm sieve[2]		628343.875	2634164.042	32.7270100	-108.1225100	--	414	Y		
FID 4		Five Year pH Monitoring Report, Arcadis 2017a	2009	0-6"	2 mm sieve[2]		631067.267	2633421.179	32.7344900	-108.1249500	--	599	Y		
FID 43		Five Year pH Monitoring Report, Arcadis 2017a	2009, 2010	0-6"	2 mm sieve[2]		603552.270	2644578.646	32.6589400	-108.0884500	--	486	Y	Removed*	Borrow Area (WBT)
FID 6		Five Year pH Monitoring Report, Arcadis 2017a	2009	0-6"	2 mm sieve[2]		619895.395	2626709.294	32.7037300	-108.1466700	--	182	Y		
FID 7		Five Year pH Monitoring Report, Arcadis 2017a	2009, 2010, 2014	0-6"	2 mm sieve[2]		610671.909	2651048.696	32.6785510	-108.0674780	--	242	Y		
FID 8		Five Year pH Monitoring Report, Arcadis 2017a	2009, 2010, 2014	0-6"	2 mm sieve[2]		606421.742	2643493.103	32.6668200	-108.0920000	--	430	Y		
R-01	U06-3016	AOC Background Report, Chino 1995	1995	0-1"	not sieved		601502.878	2608704.511	32.6530160	-108.2049930	79	71	Y	Removed	Outside vegetation alliance polygon extent
R-03	U06-3026	AOC Background Report, Chino 1995	1995	0-1"	not sieved		613627.954	2612624.503	32.6863800	-108.1923900	170	153	Y	Removed	Outside vegetation alliance polygon extent
R-05	U06-3015	AOC Background Report, Chino 1995	1995	0-1"	not sieved		607511.881	2608687.236	32.6695320	-108.2051170	186	167	Y	Removed	Outside vegetation alliance polygon extent
R-07	U06-3024	AOC Background Report, Chino 1995	1995	0-1"	not sieved		605734.870	2622372.502	32.6647720	-108.1606270	207	186	Y	Removed	Outside vegetation alliance polygon extent
R-08	U06-3028	AOC Background Report, Chino 1995	1995	0-1"	not sieved		603090.869	2613165.514	32.6574230	-108.1905160	114	103	Y	Removed	Outside vegetation alliance polygon extent

Footnotes:
[1]PreFS RAC for copper for small ground feeding bird applies to 0-6" soil sieved to < 2 mm (2000 µm). Pre-FS RAC for human health applies to 0-1" soil sieved to < 0.25 mm (250 µm). The ratio used to convert copper concentration of 0-1" sieved at <0.25 mm soils to 0-6" sieved at < 2 mm soils is from Appendix A (median ratio of SS samples) of Arcadis (2011). Multiplied copper concentration by 0.7 if outside windblown tailings (and by 1.5 if inside windblown tailings). If unsieved, multiplied by 0.9 if outside windblown tailings and by 1.3 if inside windblown tailings. The 0.9 and 1.3 are from median ratios of unsieved 0-1" soil in 2009 lab reports (at 25 m on transect) compared to sieved 0-6" co-located soil in Drexler lab report in Appendix D of the pH Monitoring Report (Appendix B to the FS Report) for soils in and outside of windblown tailings, respectively (FID 8, 18, 20 in tailings). A subset of the data collected using x-ray fluorescence as part of the Railroad Interim Removal Action (Golder 2013) was collected at 0-2 inch" and sieved at <0.25 mm; the same ratios described here were applied to these data to estimate 0 to 6 inch bgs.
[2]Data were collected for ecological endpoint and were not corrected to human health values.
[3]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as IRA.
[4]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as HWY 180.
[5]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as 2:1 slope.
[6]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as Volcanic Rock.
[7]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as NMDOT.
[8]If two samples were collected from the same location in the same sampling year (with identical sample location coordinates), an average was used in place of the two parent samples. For the co-located samples U04-1121 (SRK 2008) and FID 18 (Arcadis 2009), samples were collected in different years, and the sample from the more recent year was used (FID 18).
*Removed samples with the asterisk are set to 327 for the Theissens analysis. All other removed samples are completely voided.
-- means no data available at the location.

TABLE 3-2
STSIU Surface Soil Copper Results Adjusted to 0-6"

STSIU Feasibility Study
Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Location ID	Alternate ID	Source Report	Year Collected	Original Soil depth	Sieving Status	1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]	Northing (State Plane)	Easting (State Plane)	Latitude	Longitude	Copper Concentration[1] To Compare to HH Pre-FS RAC (250 µm sieve)	Copper Concentration[1] For Bird Pre-FS RAC Analysis (2000 µm sieve)	Pre-Interim Remedial Action (IRA) Dataset	Removed in Post-IRA Dataset	Reason Removed (also see this column's footnotes)
R-12	U06-3030	AOC Background Report, Chino 1995	1995	0-1"	not sieved		594224.561	2616782.489	32.6330850	-108.1786700	73	66	Y	Removed	Outside vegetation alliance polygon extent
R-14	U06-3037	AOC Background Report, Chino 1995	1995	0-1"	not sieved		592949.320	2624423.490	32.6296460	-108.1538360	43	39	Y	Removed	Outside vegetation alliance polygon extent
Reference Plot #1 (West)		Five Year pH Monitoring Report, Arcadis 2017a	2009, 2010, 2014	0-6"	2 mm sieve[2]		620889.236	2629291.749	32.7064820	-108.1382840	--	1857	Y		
Reference Plot #2 (North)		Five Year pH Monitoring Report, Arcadis 2017a	2010, 2014	0-6"	2 mm sieve[2]		623257.066	2631947.521	32.7130110	-108.1296710	--	672	Y		
Reference Plot #3 (Northeast)		Five Year pH Monitoring Report, Arcadis 2017a	2010, 2014	0-6"	2 mm sieve[2]		619901.600	2637640.457	32.7038310	-108.1111330	--	2457	Y		
Reference Plot #4 (East)		Five Year pH Monitoring Report, Arcadis 2017a	2010, 2014	0-6"	2 mm sieve[2]		614751.433	2639835.318	32.6896900	-108.1039550	--	1418	Y		
S78	U04-1113	Phase I Remedial Investigation Report, SRK 2008	2004	0-6"	2 mm sieve		590227.316	2632655.468	32.6222290	-108.1270720	207	207	Y		
S79	U04-1114	Phase I Remedial Investigation Report, SRK 2008	2004	0-6"	2 mm sieve		590163.699	2637659.377	32.6220920	-108.1108190	157	157	Y		
SS100	U04-1135	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		641472.113	2651849.939	32.7632140	-108.0650930	234	164	Y		
SS101	U04-1136	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		640599.572	2657436.264	32.7608480	-108.0469140	206	144	Y		
SS102	U04-1137	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		644211.219	2664449.121	32.7708120	-108.0241220	201	141	Y		
SS108	U04-1143	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		631172.925	2662553.332	32.7349650	-108.0302110	252	176	Y		
SS110	U04-1145	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		627617.998	2632796.780	32.7250040	-108.1269490	692	484	Y		
SS113	U04-1148	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		631963.248	2653021.813	32.7370850	-108.0612140	209	146	Y		
SS114	U04-1149	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		628554.990	2661385.893	32.7277630	-108.0339910	119	83	Y		
SS119D	U04-1148	Phase I Remedial Investigation Report, SRK 2008	2006	0-6"	2 mm sieve		626607.364	2654304.907	32.7223710	-108.0570040	125	125	Y		
SS120	U04-1149	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		620858.117	2661067.331	32.7066060	-108.0349800	119	83	Y		
SS149	U04-1190	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		591116.292	2649489.245	32.6247890	-108.0724030	628	440	Y		
SS150	U04-1191	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		591114.307	2653625.537	32.6248080	-108.0589680	605	424	Y		
SS151	U04-1192	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		588309.346	2635041.201	32.6169750	-108.1193070	259	181	Y		
SS152	U04-1193	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		586903.881	2640149.399	32.6131490	-108.1027050	237	166	Y	Removed	Outside vegetation alliance polygon extent
SS153	U04-1194	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		586306.127	2645235.684	32.6115400	-108.0861820	438	307	Y	Removed	Outside vegetation alliance polygon extent
SS154	U04-1195	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		586954.404	2649237.218	32.6133480	-108.0731910	372	260	Y	Removed	Outside vegetation alliance polygon extent
SS155	U04-1196	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		587030.587	2653503.773	32.6135830	-108.0593350	387	271	Y	Removed	Outside vegetation alliance polygon extent
SS157	U04-1198	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		581724.503	2649431.631	32.5989730	-108.0725210	141	99	Y	Removed	Outside vegetation alliance polygon extent
SS158	U04-1199	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		581830.815	2653847.367	32.5992920	-108.0581830	247	173	Y	Removed	Outside vegetation alliance polygon extent
SS99	U04-1134	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		639798.212	2643441.733	32.7585600	-108.0924320	93	65	Y		
West-01		Five Year Report Amendment Study, Arcadis 2017b	2008	0-6"	2 mm sieve[2]		620676.835	2629470.743	32.7059	-108.1377	--	805	Y		
West Ref-01		Five Year Report Amendment Study, Arcadis 2017b	2008	0-6"	2 mm sieve[2]		620895.653	2629286.815	32.7065	-108.1383	--	873	Y		
North Ref-01		Five Year Report Amendment Study, Arcadis 2017b	2008	0-6"	2 mm sieve[2]		623252.943	2631938.713	32.7130	-108.1297	--	1012	Y		
East Ref-01		Five Year Report Amendment Study, Arcadis 2017b	2008	0-6"	2 mm sieve[2]		614754.960	2639821.606	32.6897	-108.1040	--	977	Y		
North East Ref-01		Five Year Report Amendment Study, Arcadis 2017b	2008	0-6"	2 mm sieve[2]		619890.368	2637650.732	32.7038	-108.1111	--	3085	Y		
STS-SS-2010-016		Five Year pH Monitoring Report, Arcadis 2017a	2010	0-6"	2 mm sieve[2]		621050.986	2637356.024	32.7069880	-108.1120680	--	1120	Y		
STS-SS-2010-017		Five Year pH Monitoring Report, Arcadis 2017a	2010	0-6"	2 mm sieve[2]		617464.171	2638594.326	32.6971380	-108.1080120	--	2060	Y		
STS-SS-2010-018		Five Year pH Monitoring Report, Arcadis 2017a	2010	0-6"	2 mm sieve[2]		619916.129	2638515.163	32.7038770	-108.1082900	--	1100	Y		
T-01	U06-3007	AOC Background Report, Chino 1996	1995	0-1"	not sieved	1	611335.947	2639534.738	32.6803000	-108.1049040	1330	1729	Y		
T-03	U06-3022	AOC Background Report, Chino 1996	1995	0-1"	not sieved		597545.876	2645955.991	32.6424390	-108.0839280	554	499	Y		
T-04	U06-3008	AOC Background Report, Chino 1996	1995	0-1"	not sieved	1	604970.956	2642887.008	32.6628280	-108.0939580	549	714	Y	Removed*	Borrow Area (WBT)
T-05	U06-3018	AOC Background Report, Chino 1996	1995	0-1"	not sieved		603851.947	2645936.003	32.6597730	-108.0840420	543	489	Y	Removed*	Borrow Area (WBT)
T-08	U06-3012	AOC Background Report, Chino 1996	1995	0-1"	not sieved		594868.863	2645548.009	32.6350780	-108.0852330	647	582	Y	Removed*	Operations Reclamation Occurred
T-09	U06-3013	AOC Background Report, Chino 1996	1995	0-1"	not sieved		592399.858	2647114.986	32.6283020	-108.0801240	645	581	Y		
T-12	U06-3003	AOC Background Report, Chino 1996	1995	0-1"	not sieved		585043.572	2642599.015	32.6080520	-108.0947350	216	194	Y	Removed	Outside vegetation alliance polygon extent
T-15	U06-3001	AOC Background Report, Chino 1996	1995	0-1"	not sieved		602196.797	2633270.742	32.6551340	-108.1251810	773	696	Y		
U04-1001		AOC Background Report, Chino 1996	1995	0-1"	not sieved		619720.484	2637629.985	32.7033330	-108.1111660	3560	3204	Y		
U04-1002		AOC Background Report, Chino 1996	1995	0-1"	not sieved		616606.994	2637989.236	32.6947780	-108.1099720	5240	4716	Y	Removed*	IRA
U04-1003		AOC Background Report, Chino 1996	1995	0-1"	not sieved	1	614282.179	2638171.243	32.6883890	-108.1093600	1880	2444	Y	Removed*	Borrow Area (WBT)

Footnotes:
[1]PreFS RAC for copper for small ground feeding bird applies to 0-6" soil sieved to < 2 mm (2000 µm). Pre-FS RAC for human health applies to 0-1" soil sieved to < 0.25 mm (250 µm). The ratio used to convert copper concentration of 0-1" sieved at <0.25 mm soils to 0-6" sieved at < 2 mm soils is from Appendix A (median ratio of SS samples) of Arcadis (2011). Multiplied copper concentration by 0.7 if outside windblown tailings (and by 1.5 if inside windblown tailings). If unsieved, multiplied by 0.9 if outside windblown tailings and by 1.3 if inside windblown tailings. The 0.9 and 1.3 are from median ratios of unsieved 0-1" soil in 2009 lab reports (at 25 m on transect) compared to sieved 0-6" co-located soil in Drexler lab report in Appendix D of the pH Monitoring Report (Appendix B to the FS Report) for soils in and outside of windblown tailings, respectively (FID 8, 18, 20 in tailings). A subset of the data collected using x-ray fluorescence as part of the Railroad Interim Removal Action (Golder 2013) was collected at 0-2 inch" and sieved at <0.25 mm; the same ratios described here were applied to these data to estimate 0 to 6 inch bgs.
[2]Data were collected for ecological endpoint and were not corrected to human health values.
[3]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as IRA.
[4]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as HWY 180.
[5]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as 2:1 slope.
[6]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as Volcanic Rock.
[7]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as NMDOT.
[8]If two samples were collected from the same location in the same sampling year (with identical sample location coordinates), an average was used in place of the two parent samples. For the co-located samples U04-1121 (SRK 2008) and FID 18 (Arcadis 2009), samples were collected in different years, and the sample from the more recent year was used (FID 18).
*Removed samples with the asterisk are set to 327 for the Theissens analysis. All other removed samples are completely voided.
-- means no data available at the location.

TABLE 3-2
STSIU Surface Soil Copper Results Adjusted to 0-6"

STSIU Feasibility Study
Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Location ID	Alternate ID	Source Report	Year Collected	Original Soil depth	Sieving Status	1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]	Northing (State Plane)	Easting (State Plane)	Latitude	Longitude	Copper Concentration[1] To Compare to HH Pre-FS RAC (250 µm sieve)	Copper Concentration[1] For Bird Pre-FS RAC Analysis (2000 µm sieve)	Pre-Interim Remedial Action (IRA) Dataset	Removed in Post-IRA Dataset	Reason Removed (also see this column's footnotes)
U04-1004		AOC Background Report, Chino 1996	1995	0-1"	not sieved		616287.613	2640346.991	32.6939160	-108.1023050	1140	1140	Y		
U04-1007		AOC Background Report, Chino 1996	1995	0-1"	not sieved		620170.874	2643338.742	32.7046110	-108.0926110	845	761	Y		
U04-1008		AOC Background Report, Chino 1996	1995	0-1"	not sieved		618974.607	2640806.763	32.7013050	-108.1008320	644	580	Y		
U04-1009		AOC Background Report, Chino 1996	1995	0-1"	not sieved		617513.891	2642998.996	32.6973050	-108.0936940	803	723	Y		
U04-1010		AOC Background Report, Chino 1996	1995	0-1"	not sieved		614531.381	2643547.235	32.6891110	-108.0918880	1230	1107	Y		
U04-1011		AOC Background Report, Chino 1996	1995	0-1"	not sieved		614224.494	2640965.502	32.6882500	-108.1002780	990	891	Y		
U04-1012		AOC Background Report, Chino 1996	1995	0-1"	not sieved		616925.014	2651468.013	32.6957410	-108.0661590	309	278	Y		
U04-1013		AOC Background Report, Chino 1996	1995	0-1"	not sieved		617419.206	2648869.238	32.6970830	-108.0746110	521	469	Y		
U04-1014		AOC Background Report, Chino 1996	1995	0-1"	not sieved		620167.626	2649020.739	32.7046390	-108.0741390	504	454	Y		
U04-1015		AOC Background Report, Chino 1996	1995	0-1"	not sieved		615018.317	2654129.745	32.6905160	-108.0574940	330	297	Y		
U04-1016		AOC Background Report, Chino 1996	1995	0-1"	not sieved		614062.812	2649041.490	32.6878590	-108.0740260	922	830	Y		
U04-1017		AOC Background Report, Chino 1996	1995	0-1"	not sieved		619400.887	2655469.987	32.7025700	-108.0531670	216	194	Y		
U04-1018		AOC Background Report, Chino 1996	1995	0-1"	not sieved		646917.446	2638994.508	32.7780970	-108.1069580	175	158	Y		
U04-1019		AOC Background Report, Chino 1996	1995	0-1"	not sieved		616899.365	2660583.748	32.6957220	-108.0365270	245	221	Y		
U04-1020		AOC Background Report, Chino 1996	1995	0-1"	not sieved		617632.513	2657765.244	32.6977220	-108.0456940	436	392	Y		
U04-1021		AOC Background Report, Chino 1996	1995	0-1"	not sieved		614323.314	2660091.492	32.6886380	-108.0381110	280	252	Y		
U04-1022		AOC Background Report, Chino 1996	1995	0-1"	not sieved		626224.432	2635409.007	32.7211940	-108.1184430	1790	1611	Y		
U04-1023		AOC Background Report, Chino 1996	1995	0-1"	not sieved		622309.178	2633245.261	32.7104160	-108.1254440	3410	3069	Y		
U04-1024		AOC Background Report, Chino 1996	1995	0-1"	not sieved		620299.675	2629163.999	32.7048610	-108.1386940	2040	1836	Y		
U04-1025		AOC Background Report, Chino 1996	1995	0-1"	not sieved		618136.015	2629507.994	32.6989170	-108.1375550	2490	2241	Y	Removed	Co-located samples[8]
U04-1026		AOC Background Report, Chino 1996	1995	0-1"	not sieved		618136.015	2629507.994	32.6989170	-108.1375550	2260	2034	Y	Removed	Co-located samples[8]
U04-1028		AOC Background Report, Chino 1996	1995	0-1"	not sieved		614661.048	2629019.504	32.6893610	-108.1391110	1340	1206	Y		
U04-1029		AOC Background Report, Chino 1996	1995	0-1"	not sieved		614413.449	2627300.996	32.6886670	-108.1446940	372	335	Y		
U04-1030		AOC Background Report, Chino 1996	1995	0-1"	not sieved		617144.617	2626437.497	32.6961670	-108.1475270	837	753	Y		
U04-1031		AOC Background Report, Chino 1996	1995	0-1"	not sieved		620408.514	2626515.515	32.7051390	-108.1473050	1740	1566	Y		
U04-1032		AOC Background Report, Chino 1996	1995	0-1"	not sieved		620305.516	2623789.502	32.7048330	-108.1561660	1040	936	Y		
U04-1033		AOC Background Report, Chino 1996	1995	0-1"	not sieved		617667.820	2623832.754	32.6975840	-108.1559990	562	506	Y		
U04-1034		AOC Background Report, Chino 1996	1995	0-1"	not sieved		614629.424	2623635.258	32.6892300	-108.1566110	424	382	Y		
U04-1035	S1	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		624828.375	2632803.169	32.7173370	-108.1269040	1240	868	Y		
U04-1036	S2	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		624569.668	2633792.886	32.7166330	-108.1236830	625	438	Y		
U04-1037	S3	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		623568.661	2631796.422	32.7138670	-108.1301660	2110	1477	Y		
U04-1038	S4	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		623569.772	2632795.224	32.7138770	-108.1269180	7990	5593	Y	Removed*	IRA
U04-1039	S5	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		623570.878	2633793.995	32.7138880	-108.1236710	1140	798	Y		
U04-1040	S6	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		622567.666	2629799.959	32.7111000	-108.1366470	3670	2569	Y		
U04-1041	S7	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		622568.754	2630798.730	32.7111110	-108.1334000	4760	3332	Y		
U04-1042	S8	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		622569.871	2631797.532	32.7111210	-108.1301530	6100	4270	Y	Removed*	IRA
U04-1043	S9	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		622570.983	2632796.334	32.7111320	-108.1269060	4950	3465	Y	Removed*	IRA
U04-1044	S10	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		622572.089	2633795.104	32.7111430	-108.1236580	6090	4263	Y	Removed*	IRA
U04-1045	S11	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		621567.747	2628802.267	32.7083430	-108.1398820	3880	2716	Y		
U04-1046	S12	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		621568.877	2629801.069	32.7083540	-108.1366340	3160	2212	Y		
U04-1047	S13	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		621832.985	2630832.143	32.7090890	-108.1332850	5920	4144	Y	Removed*	IRA
U04-1048	S14	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		621621.071	2631798.629	32.7085140	-108.1301410	8030	5621	Y	Removed*	IRA
U04-1049	S15	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		621622.183	2632797.429	32.7085240	-108.1268930	12100	8470	Y	Removed*	IRA
U04-1050	S16	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		621573.301	2633796.214	32.7083970	-108.1236460	8310	5817	Y	Removed*	IRA
U04-1051	S17	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		620568.957	2628803.378	32.7055980	-108.1398690	4650	3255	Y		
U04-1052	S18	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		620570.087	2629802.180	32.7056090	-108.1366220	3670	2569	Y		
U04-1053	S19	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		620571.163	2630650.967	32.7056190	-108.1338620	5660	3962	Y	Removed*	IRA

Footnotes:
[1]PreFS RAC for copper for small ground feeding bird applies to 0-6" soil sieved to < 2 mm (2000 µm). Pre-FS RAC for human health applies to 0-1" soil sieved to < 0.25 mm (250 µm). The ratio used to convert copper concentration of 0-1" sieved at <0.25 mm soils to 0-6" sieved at < 2 mm soils is from Appendix A (median ratio of SS samples) of Arcadis (2011). Multiplied copper concentration by 0.7 if outside windblown tailings (and by 1.5 if inside windblown tailings). If unsieved, multiplied by 0.9 if outside windblown tailings and by 1.3 if inside windblown tailings. The 0.9 and 1.3 are from median ratios of unsieved 0-1" soil in 2009 lab reports (at 25 m on transect) compared to sieved 0-6" co-located soil in Drexler lab report in Appendix D of the pH Monitoring Report (Appendix B to the FS Report) for soils in and outside of windblown tailings, respectively (FID 8, 18, 20 in tailings). A subset of the data collected using x-ray fluorescence as part of the Railroad Interim Removal Action (Golder 2013) was collected at 0-2 inch" and sieved at <0.25 mm; the same ratios described here were applied to these data to estimate 0 to 6 inch bgs.
[2]Data were collected for ecological endpoint and were not corrected to human health values.
[3]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as IRA.
[4]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as HWY 180.
[5]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as 2:1 slope.
[6]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as Volcanic Rock.
[7]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as NMDOT.
[8]If two samples were collected from the same location in the same sampling year (with identical sample location coordinates), an average was used in place of the two parent samples. For the co-located samples U04-1121 (SRK 2008) and FID 18 (Arcadis 2009), samples were collected in different years, and the sample from the more recent year was used (FID 18).
*Removed samples with the asterisk are set to 327 for the Theissens analysis. All other removed samples are completely voided.
-- means no data available at the location.

TABLE 3-2
STSIU Surface Soil Copper Results Adjusted to 0-6"

STSIU Feasibility Study
Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Location ID	Alternate ID	Source Report	Year Collected	Original Soil depth	Sieving Status	1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]	Northing (State Plane)	Easting (State Plane)	Latitude	Longitude	Copper Concentration[1] To Compare to HH Pre-FS RAC (250 µm sieve)	Copper Concentration[1] For Bird Pre-FS RAC Analysis (2000 µm sieve)	Pre-Interim Remedial Action (IRA) Dataset	Removed in Post-IRA Dataset	Reason Removed (also see this column's footnotes)
U04-1054	S20	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		619570.168	2628804.490	32.7028530	-108.1398560	4240	2968	Y		
U04-1055	S21	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		619571.298	2629803.292	32.7028640	-108.1366090	6670	4669	Y	Removed*	IRA
U04-1056	S22	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		619572.375	2630652.074	32.7028740	-108.1338490	5210	3647	Y	Removed*	IRA
U04-1057	S23	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		618571.379	2628805.602	32.7001080	-108.1398430	3030	2121	Y		
U04-1058	S24	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		618572.474	2629804.373	32.7001190	-108.1365960	3910	2737	Y		
U04-1059	S25	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		618573.595	2630573.170	32.7001280	-108.1340970	4630	3241	Y		
U04-1060	S26	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		617572.591	2628806.714	32.6973620	-108.1398300	2600	1820	Y		
U04-1061	S27	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		617573.722	2629805.486	32.6973730	-108.1365830	3150	2205	Y		
U04-1062	S28	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		617722.047	2630675.655	32.6977880	-108.1337560	5840	4088	Y	Removed*	IRA
U04-1063	S29	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		616573.803	2628807.797	32.6946170	-108.1398170	1690	1183	Y		
U04-1064	S30	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		616574.934	2629806.599	32.6946280	-108.1365700	2350	1645	Y		
U04-1065	S31	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		616576.028	2630945.404	32.6946400	-108.1328680	3120	2184	Y	Removed*	IRA
U04-1066	S32	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		614738.172	2631502.664	32.6895930	-108.1310400	2440	1708	Y		
U04-1067	S33	Phase I Remedial Investigation Report, SRK 2008	2004	0-6"	2 mm sieve		614819.581	2632616.098	32.6898250	-108.1274220	2570	1799	Y		
U04-1068	S34	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		614621.475	2633582.318	32.6892880	-108.1242790	4340	3038	Y	Removed*	Borrow Area
U04-1069	S35	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		619917.989	2637094.013	32.7038720	-108.1129100	3270	2289	Y		
U04-1070	S36	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		620098.555	2637938.300	32.7043740	-108.1101670	3970	2779	Y		
U04-1071	S37	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		619153.985	2636938.994	32.7017710	-108.1134070	1900	1330	Y	Removed*	IRA
U04-1072	S38	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		619114.575	2637995.777	32.7016700	-108.1099720	4280	2996	Y	Removed*	IRA
U04-1073	S39	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		619215.672	2638994.570	32.7019550	-108.1067260	2470	1729	Y		
U04-1074	S40	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		619095.817	2639979.752	32.7016330	-108.1035220	3610	2527	Y		
U04-1075	S41	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		618114.662	2636998.112	32.6989150	-108.1132060	8170	5719	Y	Removed*	IRA
U04-1076	S42	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		618115.788	2638276.889	32.6989270	-108.1090490	5780	4046	Y	Removed*	IRA
U04-1077	S43	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		618116.874	2638995.675	32.6989350	-108.1067130	2230	1561	Y		
U04-1078	S44	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		618117.989	2639994.456	32.6989450	-108.1034660	908	636	Y		
U04-1080	S45	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		617122.988	2636799.997	32.6961870	-108.1138420	8270	5789	Y	Removed*	IRA
U04-1081	S56	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		615121.637	2639997.778	32.6907090	-108.1034300	1490	1043	Y		
U04-1082	S46	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		617062.038	2637466.991	32.6960250	-108.1116730	9000	6300	Y	Removed*	IRA
U04-1083	S47	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		617043.999	2638791.997	32.6959850	-108.1073660	7990	5593	Y	Removed*	IRA
U04-1084	S48	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		617119.205	2639995.573	32.6962000	-108.1034540	2520	1764	Y		
U04-1085	S49	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		616117.092	2637000.316	32.6934240	-108.1131820	5430	3801	Y	Removed*	IRA
U04-1086	S50	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		616538.208	2637999.086	32.6945890	-108.1099390	272	190	Y	Removed*	IRA
U04-1087	S51	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		616187.982	2639001.994	32.6936330	-108.1066760	3790	2653	Y		
U04-1088	S52	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		616229.993	2639999.985	32.6937560	-108.1034320	1540	1078	Y		
U04-1089	S53	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		615273.013	2637203.997	32.6911050	-108.1125130	7880	5516	Y	Removed*	IRA
U04-1090	S54	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		615123.013	2638107.010	32.6907000	-108.1095760	2220	1554	Y	Removed*	Operations Reclamation Occurred
U04-1091	S55	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve	1	614772.990	2639145.989	32.6897450	-108.1061960	1740	2610	Y	Removed*	Operations Reclamation Occurred
U04-1092	S57	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve	1	614120.615	2638001.335	32.6879440	-108.1099110	1300	1950	Y	Removed*	Borrow Area (WBT)
U04-1093	S58	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve	1	614121.707	2638800.108	32.6879520	-108.1073150	1590	2385	Y		
U04-1094	S59	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		619669.075	2633601.331	32.7031620	-108.1242620	14100	9870	Y	Removed*	Borrow Area (WBT)
U04-1095	S60	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		619304.400	2633476.887	32.7021590	-108.1246640	18300	12810	Y	Removed*	Operations Reclamation Occurred
U04-1096	S61	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		618098.153	2633588.316	32.6988440	-108.1242910	30500	21350	Y	Removed*	Operations Reclamation Occurred
U04-1097	S62	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		617761.561	2633757.139	32.6979200	-108.1237390	20100	14070	Y	Removed*	Operations Reclamation Occurred
U04-1098	S63	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		617309.661	2633732.061	32.6966780	-108.1238160	10500	7350	Y	Removed*	Operations Reclamation Occurred
U04-1099	S64	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		636499.167	2631183.440	32.7494030	-108.1322770	689	482	Y	Removed*	IRA
U04-1100	S65	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		634421.253	2631557.573	32.7436950	-108.1310410	660	462	Y	Removed*	IRA
U04-1101	S66	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		632606.094	2631426.465	32.7387040	-108.1314510	789	552	Y	Removed*	IRA

Footnotes:
[1]PreFS RAC for copper for small ground feeding bird applies to 0-6" soil sieved to < 2 mm (2000 µm). Pre-FS RAC for human health applies to 0-1" soil sieved to < 0.25 mm (250 µm). The ratio used to convert copper concentration of 0-1" sieved at <0.25 mm soils to 0-6" sieved at < 2 mm soils is from Appendix A (median ratio of SS samples) of Arcadis (2011). Multiplied copper concentration by 0.7 if outside windblown tailings (and by 1.5 if inside windblown tailings). If unsieved, multiplied by 0.9 if outside windblown tailings and by 1.3 if inside windblown tailings. The 0.9 and 1.3 are from median ratios of unsieved 0-1" soil in 2009 lab reports (at 25 m on transect) compared to sieved 0-6" co-located soil in Drexler lab report in Appendix D of the pH Monitoring Report (Appendix B to the FS Report) for soils in and outside of windblown tailings, respectively (FID 8, 18, 20 in tailings). A subset of the data collected using x-ray fluorescence as part of the Railroad Interim Removal Action (Golder 2013) was collected at 0-2 inch" and sieved at <0.25 mm; the same ratios described here were applied to these data to estimate 0 to 6 inch bgs.
[2]Data were collected for ecological endpoint and were not corrected to human health values.
[3]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as IRA.
[4]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as HWY 180.
[5]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as 2:1 slope.
[6]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as Volcanic Rock.
[7]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as NMDOT.
[8]If two samples were collected from the same location in the same sampling year (with identical sample location coordinates), an average was used in place of the two parent samples. For the co-located samples U04-1121 (SRK 2008) and FID 18 (Arcadis 2009), samples were collected in different years, and the sample from the more recent year was used (FID 18).
*Removed samples with the asterisk are set to 327 for the Theissens analysis. All other removed samples are completely voided.
-- means no data available at the location.

TABLE 3-2
STSIU Surface Soil Copper Results Adjusted to 0-6"

STSIU Feasibility Study
Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Location ID	Alternate ID	Source Report	Year Collected	Original Soil depth	Sieving Status	1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]	Northing (State Plane)	Easting (State Plane)	Latitude	Longitude	Copper Concentration[1]		Pre-Interim Remedial Action (IRA) Dataset	Removed in Post-IRA Dataset	Reason Removed (also see this column's footnotes)
											To Compare to HH Pre-FS RAC (250 µm sieve)	For Bird Pre-FS RAC Analysis (2000 µm sieve)			
U04-1102	S67	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		630502.857	2631596.101	32.7329250	-108.1308800	899	629	Y	Removed	IRA, and outside vegetation polygons
U04-1103	S68	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		628776.576	2630809.538	32.7281740	-108.1334220	846	592	Y	Removed	IRA, and outside vegetation polygons
U04-1104	S69	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		626776.667	2630643.433	32.7226750	-108.1339440	710	497	Y	Removed*	IRA
U04-1105	S70	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		624446.087	2630119.691	32.7162650	-108.1356250	2280	1596	Y	Removed*	IRA
U04-1106	S71	Phase I Remedial Investigation Report, SRK 2008	2004	0-1"	0.25 mm sieve		622021.990	2630472.006	32.7096050	-108.1344570	5350	3745	Y	Removed*	IRA
U04-1107	S72	Phase I Remedial Investigation Report, SRK 2008	2004	0-6"	2 mm sieve		611902.416	2632139.171	32.6818030	-108.1289450	1160	1160	Y	Removed*	Borrow Area
U04-1108	S73	Phase I Remedial Investigation Report, SRK 2008	2004	0-6"	2 mm sieve		607892.366	2632378.882	32.6707830	-108.1281300	1290	1290	Y	Removed*	IRA
U04-1109	S74	Phase I Remedial Investigation Report, SRK 2008	2004	0-6"	2 mm sieve		604073.534	2632216.309	32.6602850	-108.1286240	529	529	Y	Removed*	IRA
U04-1110	S75	Phase I Remedial Investigation Report, SRK 2008	2004	0-6"	2 mm sieve		600284.039	2635391.253	32.6498920	-108.1182740	940	940	Y	Removed*	IRA
U04-1111	S76	Phase I Remedial Investigation Report, SRK 2008	2004	0-6"	2 mm sieve		598479.705	2631986.860	32.6449070	-108.1293190	278	278	Y	Removed*	IRA
U04-1112	S77	Phase I Remedial Investigation Report, SRK 2008	2004	0-6"	2 mm sieve		594805.310	2634139.935	32.6348240	-108.1222910	267	267	Y	Removed*	IRA
U04-1115	S80	Phase I Remedial Investigation Report, SRK 2008	2004	0-6"	2 mm sieve		611644.482	2639342.182	32.6811470	-108.1055320	1440	1440	Y	Removed*	IRA
U04-1116	S81	Phase I Remedial Investigation Report, SRK 2008	2004	0-6"	2 mm sieve		611644.489	2641276.198	32.6811600	-108.0992470	875	875	Y	Removed*	IRA
U04-1117	S82	Phase I Remedial Investigation Report, SRK 2008	2004	0-6"	2 mm sieve		611644.477	2643832.465	32.6811780	-108.0909380	455	455	Y	Removed*	IRA
U04-1118	S83	Phase I Remedial Investigation Report, SRK 2008	2004	0-6"	2 mm sieve		611644.496	2646833.881	32.6811980	-108.0811830	358	358	Y	Removed*	IRA
U04-1119	S84	Phase I Remedial Investigation Report, SRK 2008	2004	0-6"	2 mm sieve		609070.684	2639524.941	32.6740740	-108.1049170	362	362	Y	Removed*	Borrow Area (WBT)
U04-1120	S85	Phase I Remedial Investigation Report, SRK 2008	2004	0-6"	2 mm sieve		609053.370	2641276.198	32.6740380	-108.0992260	451	451	Y	Removed*	IRA
U04-1121	S86	Phase I Remedial Investigation Report, SRK 2008	2004	0-6"	2 mm sieve		609040.575	2643554.287	32.6740190	-108.0918220	513	513	Y	Removed	IRA, and Co-located with FID18[8]
U04-1122	S87	Phase I Remedial Investigation Report, SRK 2008	2004	0-6"	2 mm sieve		608718.726	2646702.118	32.6731550	-108.0815890	309	309	Y	Removed*	IRA
U04-1123	S88	Phase I Remedial Investigation Report, SRK 2008	2004	0-6"	2 mm sieve		608982.076	2649674.237	32.6738970	-108.0719320	484	484	Y	Removed*	IRA
U04-1124	S89	Phase I Remedial Investigation Report, SRK 2008	2004	0-6"	2 mm sieve		608923.551	2652338.921	32.6737530	-108.0632720	399	399	Y	Removed*	IRA
U04-1125	S90	Phase I Remedial Investigation Report, SRK 2008	2004	0-6"	2 mm sieve		610033.010	2654619.677	32.6768150	-108.0558680	255	255	Y	Removed*	IRA
U04-1126	S91	Phase I Remedial Investigation Report, SRK 2008	2004	0-6"	2 mm sieve		606644.353	2641432.274	32.6674180	-108.0986990	926	926	Y	Removed*	Borrow Area (WBT)
U04-1127	S92	Phase I Remedial Investigation Report, SRK 2008	2004	0-6"	2 mm sieve		606422.035	2643492.150	32.6668210	-108.0920030	581	581	Y	Removed*	IRA
U04-1128	S93	Phase I Remedial Investigation Report, SRK 2008	2004	0-6"	2 mm sieve		606114.831	2646863.157	32.6659990	-108.0810460	308	308	Y	Removed*	IRA
U04-1129	S94	Phase I Remedial Investigation Report, SRK 2008	2004	0-6"	2 mm sieve		605980.775	2649396.070	32.6656460	-108.0728140	313	313	Y	Removed*	IRA
U04-1130	S95	Phase I Remedial Investigation Report, SRK 2008	2004	0-6"	2 mm sieve		605880.764	2652324.267	32.6653890	-108.0632980	494	494	Y	Removed*	IRA
U04-1131	S96	Phase I Remedial Investigation Report, SRK 2008	2004	0-6"	2 mm sieve		605880.775	2654606.509	32.6654020	-108.0558820	237	237	Y	Removed*	IRA
U04-1132	SS97	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		637427.998	2626618.020	32.7519200	-108.1471360	412	288	Y	Removed	Outside vegetation alliance polygon extent
U04-1133	SS98	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		635774.103	2633431.123	32.7474270	-108.1249600	475	333	Y		
U04-1138	SS103	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		634646.148	2629136.154	32.7442940	-108.1389190	497	348	Y	Removed	Outside vegetation alliance polygon extent
U04-1139	SS104	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		637100.810	2637111.981	32.7511010	-108.1129990	407	285	Y		
U04-1140	SS105	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		630420.457	2629367.294	32.7326810	-108.1381270	226	158	Y	Removed	Outside vegetation alliance polygon extent
U04-1141	SS106	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		629959.282	2633598.330	32.7314460	-108.1243640	531	372	Y		
U04-1142	SS107	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		630571.557	2648666.947	32.7332330	-108.0753660	194	136	Y		
U04-1144	SS109	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		626521.117	2629434.410	32.7219640	-108.1378730	597	418	Y	Removed	Outside vegetation alliance polygon extent
U04-1146	SS111	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		626557.249	2640293.451	32.7221440	-108.1025640	551	386	Y		
U04-1147	SS112	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		624722.087	2645057.303	32.7171320	-108.0870590	558	391	Y		
U04-1150	SS115	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		622615.631	2628720.620	32.7112230	-108.1401570	3800	2660	Y		
U04-1151	SS116	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		622537.457	2634957.532	32.7110560	-108.1198790	1460	1022	Y		
U04-1152	SS117	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		619724.047	2637658.448	32.7033430	-108.1110740	4450	3115	Y		
U04-1154	SS118D	Phase I Remedial Investigation Report, SRK 2008	2006	0-6"	0.25 mm sieve		619356.828	2643030.467	32.7023710	-108.0936070	259	259	Y		
U04-1158	SS121	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		616358.262	2644604.416	32.6941390	-108.0884660	896	627	Y		
U04-1159	SS122	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		617920.943	2651011.046	32.6984750	-108.0676520	119	83	Y		
U04-1160	SS123	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		618270.278	2660077.824	32.6994870	-108.0381800	449	314	Y		
U04-1162	SS124D	Phase I Remedial Investigation Report, SRK 2008	2006	0-6"	2 mm sieve		613136.715	2643481.011	32.6852770	-108.0920930	523	523	Y		
U04-1164	SS125D	Phase I Remedial Investigation Report, SRK 2008	2006	0-6"	2 mm sieve		614418.219	2646924.196	32.6888220	-108.0809110	166	166	Y		

Footnotes:
[1]PreFS RAC for copper for small ground feeding bird applies to 0-6" soil sieved to < 2 mm (2000 µm). Pre-FS RAC for human health applies to 0-1" soil sieved to < 0.25 mm (250 µm). The ratio used to convert copper concentration of 0-1" sieved at <0.25 mm soils to 0-6" sieved at < 2 mm soils is from Appendix A (median ratio of SS samples) of Arcadis (2011). Multiplied copper concentration by 0.7 if outside windblown tailings (and by 1.5 if inside windblown tailings). If unsieved, multiplied by 0.9 if outside windblown tailings and by 1.3 if inside windblown tailings. The 0.9 and 1.3 are from median ratios of unsieved 0-1" soil in 2009 lab reports (at 25 m on transect) compared to sieved 0-6" co-located soil in Drexler lab report in Appendix D of the pH Monitoring Report (Appendix B to the FS Report) for soils in and outside of windblown tailings, respectively (FID 8, 18, 20 in tailings). A subset of the data collected using x-ray fluorescence as part of the Railroad Interim Removal Action (Golder 2013) was collected at 0-2 inch" and sieved at <0.25 mm; the same ratios described here were applied to these data to estimate 0 to 6 inch bgs.
[2]Data were collected for ecological endpoint and were not corrected to human health values.
[3]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as IRA.
[4]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as HWY 180.
[5]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as 2:1 slope.
[6]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as Volcanic Rock.
[7]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as NMDOT.
[8]If two samples were collected from the same location in the same sampling year (with identical sample location coordinates), an average was used in place of the two parent samples. For the co-located samples U04-1121 (SRK 2008) and FID 18 (Arcadis 2009), samples were collected in different years, and the sample from the more recent year was used (FID 18).
*Removed samples with the asterisk are set to 327 for the Theissens analysis. All other removed samples are completely voided.
-- means no data available at the location.

TABLE 3-2
STSIU Surface Soil Copper Results Adjusted to 0-6"

STSIU Feasibility Study
Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Location ID	Alternate ID	Source Report	Year Collected	Original Soil depth	Sieving Status	1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]	Northing (State Plane)	Easting (State Plane)	Latitude	Longitude	Copper Concentration[1] To Compare to HH Pre-FS RAC (250 µm sieve)	Copper Concentration[1] For Bird Pre-FS RAC Analysis (2000 µm sieve)	Pre-Interim Remedial Action (IRA) Dataset	Removed in Post-IRA Dataset	Reason Removed (also see this column's footnotes)
U04-1166	SS127	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve	1	611472.745	2639334.203	32.6806750	-108.1055570	1020	1530	Y	Removed*	Operations Reclamation Occurred
U04-1167	SS128	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		610232.840	2643833.807	32.6772980	-108.0909230	454	318	Y		
U04-1169	SS129D	Phase I Remedial Investigation Report, SRK 2008	2006	0-6"	2 mm sieve		610225.692	2647038.444	32.6772990	-108.0805080	337	337	Y		
U04-1170	SS130	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		609836.416	2648758.761	32.6762400	-108.0749140	227	159	Y		
U04-1172	SS131D	Phase I Remedial Investigation Report, SRK 2008	2006	0-6"	2 mm sieve		608828.195	2652641.959	32.6734920	-108.0622870	444	444	Y		
U04-1173	SS132	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		609872.552	2656225.634	32.6763840	-108.0506470	740	518	Y		
U04-1175	SS134	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		607686.946	2641645.297	32.6702850	-108.0980150	334	234	Y	Removed*	Borrow Area
U04-1176	SS135	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		607622.876	2646317.770	32.6701400	-108.0828300	325	228	Y		
U04-1178	SS137	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		604779.260	2645970.444	32.6623220	-108.0839370	309	216	Y		
U04-1179	SS138	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		604181.195	2648650.026	32.6606950	-108.0752250	297	208	Y		
U04-1180	SS139	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		603965.828	2654756.863	32.6601400	-108.0553800	696	487	Y		
U04-1182	SS141	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve	1	600331.132	2645745.850	32.6500940	-108.0846330	320	480	Y		
U04-1183	SS142	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		600051.517	2648815.812	32.6493450	-108.0746560	392	274	Y		
U04-1184	SS143	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		599665.717	2653313.162	32.6483120	-108.0600420	738	517	Y		
U04-1186	SS145	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		595143.914	2645115.445	32.6358320	-108.0866410	413	289	Y	Removed*	Operations Reclamation Occurred
U04-1187	SS146	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		596593.531	2646775.843	32.6398270	-108.0812580	710	497	Y		
U04-1189	SS148	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		591404.984	2646739.168	32.6255650	-108.0813380	632	442	Y		
U04-1197	SS156	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		581860.832	2645274.110	32.5993220	-108.0860230	196	137	Y	Removed	Outside vegetation alliance polygon extent
U04-1200	ERA159D	Phase I Remedial Investigation Report, SRK 2008	2006	0-6"	2 mm sieve		621281.566	2629231.851	32.7075600	-108.1384820	809	809	Y		
U04-1201	ERA160D	Phase I Remedial Investigation Report, SRK 2008	2006	0-6"	2 mm sieve		617981.850	2629323.502	32.6984910	-108.1381540	34	34	Y		
U04-1202	ERA161D	Phase I Remedial Investigation Report, SRK 2008	2006	0-6"	2 mm sieve		614800.499	2629297.316	32.6897470	-108.1382090	556	556	Y		
U04-1203	ERA162	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		642299.465	2640321.566	32.7654130	-108.1026020	218	153	Y		
U04-1204	ERA163	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		643634.282	2638580.311	32.7690700	-108.1082780	208	146	Y		
U04-1205	ERA164	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		634282.684	2668911.418	32.7435430	-108.0095510	136	95	Y		
U04-1206	ERA165	Phase I Remedial Investigation Report, SRK 2008	2006	0-1"	0.25 mm sieve		636311.445	2663927.294	32.7490960	-108.0257730	177	124	Y		
U05-4001	HR-01	AOC Background Report, Chino 1996	1995	0-1"	not sieved		641994.280	2619158.142	32.7644080	-108.1714470	318	286	Y	Removed	Outside vegetation alliance polygon extent
U05-4004	HR-02	AOC Background Report, Chino 1996	1995	0-1"	not sieved		640329.186	2615792.561	32.7598010	-108.1823780	216	194	Y	Removed	Outside vegetation alliance polygon extent
STS-CG-2011-1	UN04-2530	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		607429.590	2631002.115	32.6695	-108.1326	--	274	Y		
STS-CG-2011-2	UN04-2531	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		607755.378	2631587.698	32.6704	-108.1307	--	288	Y		
STS-CG-2011-3	UN04-2532	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		608117.556	2632173.370	32.6714	-108.1288	--	573	Y		
STS-CG-2011-4	UN04-2533	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		608443.365	2632758.928	32.6723	-108.1269	--	337	Y		
STS-CG-2011-5	UN04-2534	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		613437.925	2629111.540	32.6860	-108.1388	--	309	Y		
STS-CG-2011-6	UN04-2535	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		613908.764	2629851.279	32.6873	-108.1364	--	316	Y		
STS-CG-2011-7	UN04-2536	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		614307.032	2630529.261	32.6884	-108.1342	--	627	Y		
STS-CG-2011-8	UN04-2537	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		614705.486	2631145.696	32.6895	-108.1322	--	490	Y		
STS-CG-2011-9	UN04-2538	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		620130.409	2629715.256	32.7044	-108.1369	--	646	Y		
STS-CG-2011-10	UN04-2539	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		620110.030	2637128.386	32.7044	-108.1128	--	1930	Y		
STS-CG-2011-11	UN04-2540	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		620386.845	2629100.792	32.7051	-108.1389	--	1370	Y		
STS-CG-2011-12	UN04-2541	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		620508.770	2637683.112	32.7055	-108.1110	--	1670	Y		
STS-CG-2011-13	UN04-2542	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		620643.472	2628424.819	32.7058	-108.1411	--	906	Y		
STS-CG-2011-14	UN04-2543	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		620936.314	2627810.481	32.7066	-108.1431	--	977	Y		
STS-CG-2011-15	UN04-2544	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		621089.907	2638053.743	32.7071	-108.1098	--	1790	Y		
STS-CG-2011-16	UN04-2545	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		621096.581	2635531.510	32.7071	-108.1180	--	949	Y		
STS-CG-2011-17	UN04-2546	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		621192.787	2627196.046	32.7073	-108.1451	--	637	Y		
STS-CG-2011-18	UN04-2547	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		621495.294	2636086.239	32.7082	-108.1162	--	1640	Y		
STS-CG-2011-19	UN04-2548	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		621486.108	2626427.936	32.7081	-108.1476	--	1050	Y		

Footnotes:
[1]PreFS RAC for copper for small ground feeding bird applies to 0-6" soil sieved to < 2 mm (2000 µm). Pre-FS RAC for human health applies to 0-1" soil sieved to < 0.25 mm (250 µm). The ratio used to convert copper concentration of 0-1" sieved at <0.25 mm soils to 0-6" sieved at < 2 mm soils is from Appendix A (median ratio of SS samples) of Arcadis (2011). Multiplied copper concentration by 0.7 if outside windblown tailings (and by 1.5 if inside windblown tailings). If unsieved, multiplied by 0.9 if outside windblown tailings and by 1.3 if inside windblown tailings. The 0.9 and 1.3 are from median ratios of unsieved 0-1" soil in 2009 lab reports (at 25 m on transect) compared to sieved 0-6" co-located soil in Drexler lab report in Appendix D of the pH Monitoring Report (Appendix B to the FS Report) for soils in and outside of windblown tailings, respectively (FID 8, 18, 20 in tailings). A subset of the data collected using x-ray fluorescence as part of the Railroad Interim Removal Action (Golder 2013) was collected at 0-2 inch" and sieved at <0.25 mm; the same ratios described here were applied to these data to estimate 0 to 6 inch bgs.
[2]Data were collected for ecological endpoint and were not corrected to human health values.
[3]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as IRA.
[4]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as HWY 180.
[5]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as 2:1 slope.
[6]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as Volcanic Rock.
[7]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as NMDOT.
[8]If two samples were collected from the same location in the same sampling year (with identical sample location coordinates), an average was used in place of the two parent samples. For the co-located samples U04-1121 (SRK 2008) and FID 18 (Arcadis 2009), samples were collected in different years, and the sample from the more recent year was used (FID 18).
*Removed samples with the asterisk are set to 327 for the Theissens analysis. All other removed samples are completely voided.
-- means no data available at the location.

TABLE 3-2
STSIU Surface Soil Copper Results Adjusted to 0-6"

STSIU Feasibility Study
Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Location ID	Alternate ID	Source Report	Year Collected	Original Soil depth	Sieving Status	1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]	Northing (State Plane)	Easting (State Plane)	Latitude	Longitude	Copper Concentration[1] To Compare to HH Pre-FS RAC (250 µm sieve)	Copper Concentration[1] For Bird Pre-FS RAC Analysis (2000 µm sieve)	Pre-Interim Remedial Action (IRA) Dataset	Removed in Post-IRA Dataset	Reason Removed (also see this column's footnotes)
STS-CG-2011-20	UN04-2549	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		621634.667	2638424.267	32.7086	-108.1086	--	555	Y		
STS-CG-2011-21	UN04-2550	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		621779.172	2625752.115	32.7089	-108.1498	--	448	Y		
STS-CG-2011-22	UN04-2551	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		621857.635	2636640.857	32.7092	-108.1144	--	1560	Y		
STS-CG-2011-23	UN04-2552	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		621875.836	2630027.838	32.7092	-108.1359	--	2070	Y		
STS-CG-2011-24	UN04-2553	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		622072.158	2625107.064	32.7097	-108.1519	--	917	Y		
STS-CG-2011-25	UN04-2554	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		622204.941	2629444.371	32.7101	-108.1378	--	1640	Y		
STS-CG-2011-26	UN04-2555	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		622215.733	2638825.631	32.7102	-108.1073	--	416	Y		
STS-CG-2011-27	UN04-2556	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		622256.448	2637164.802	32.7103	-108.1127	--	1870	Y		
STS-CG-2011-28	UN04-2557	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		622328.775	2624461.914	32.7104	-108.1540	--	606	Y		
STS-CG-2011-29	UN04-2558	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		622534.235	2628799.401	32.7110	-108.1399	--	1390	Y		
STS-CG-2011-30	UN04-2559	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		622618.808	2637719.395	32.7113	-108.1109	--	575	Y		
STS-CG-2011-31	UN04-2560	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		622664.893	2634090.109	32.7114	-108.1227	--	1770	Y		
STS-CG-2011-32	UN04-2561	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		622674.128	2630768.302	32.7114	-108.1335	--	1500	Y		
STS-CG-2011-33	UN04-2562	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		622760.423	2639226.887	32.7117	-108.1060	--	666	Y		
STS-CG-2011-34	UN04-2563	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		622900.103	2628093.036	32.7120	-108.1422	--	1190	Y		
STS-CG-2011-35	UN04-2564	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		623017.478	2638304.828	32.7124	-108.1090	--	362	Y		
STS-CG-2011-36	UN04-2565	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		623192.862	2627509.500	32.7128	-108.1441	--	507	Y		
STS-CG-2011-37	UN04-2566	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		623293.397	2630493.241	32.7131	-108.1344	--	1560	Y		
STS-CG-2011-38	UN04-2567	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		623416.239	2638859.490	32.7135	-108.1072	--	633	Y		
STS-CG-2011-39	UN04-2568	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		623425.899	2635199.438	32.7135	-108.1191	--	682	Y		
STS-CG-2011-40	UN04-2569	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		623522.013	2626926.083	32.7137	-108.1460	--	608	Y	Removed	Outside vegetation alliance polygon extent
STS-CG-2011-41	UN04-2570	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		623723.505	2632801.217	32.7143	-108.1269	--	321	Y		
STS-CG-2011-42	UN04-2571	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		623824.524	2635784.887	32.7146	-108.1172	--	958	Y		
STS-CG-2011-43	UN04-2572	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		623851.357	2626281.164	32.7146	-108.1481	--	626	Y	Removed	Outside vegetation alliance polygon extent
STS-CG-2011-44	UN04-2573	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		623949.050	2630218.294	32.7149	-108.1353	--	761	Y		
STS-CG-2011-45	UN04-2574	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		624180.622	2625667.014	32.7155	-108.1501	--	668	Y	Removed	Outside vegetation alliance polygon extent
STS-CG-2011-46	UN04-2575	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		624186.779	2636370.226	32.7156	-108.1153	--	1100	Y		
STS-CG-2011-47	UN04-2576	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		624414.752	2632803.131	32.7162	-108.1269	--	472	Y		
STS-CG-2011-48	UN04-2577	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		624568.324	2629943.254	32.7166	-108.1362	--	1260	Y		
STS-CG-2011-49	UN04-2578	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		624585.425	2636955.648	32.7167	-108.1134	--	733	Y		
STS-CG-2011-50	UN04-2579	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		624984.163	2637510.300	32.7178	-108.1116	--	620	Y		
STS-CG-2011-51	UN04-2580	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		625069.617	2632804.945	32.7180	-108.1269	--	463	Y		
STS-CG-2011-52	UN04-2581	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		625187.600	2629668.225	32.7183	-108.1371	--	780	Y	Removed	Outside vegetation alliance polygon extent
STS-CG-2011-53	UN04-2582	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		625760.950	2632776.104	32.7199	-108.1270	--	426	Y		
STS-CG-2011-54	UN04-2583	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		625879.731	2629362.661	32.7202	-108.1381	--	1100	Y	Removed	Outside vegetation alliance polygon extent
STS-CG-2011-55	UN04-2584	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		626452.197	2632778.020	32.7218	-108.1270	--	633	Y		
STS-CG-2011-56	UN04-2585	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		626498.924	2629118.409	32.7219	-108.1389	--	177	Y	Removed	Outside vegetation alliance polygon extent
STS-CG-2011-57	UN04-2586	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		627154.679	2628812.764	32.7237	-108.1399	--	434	Y	Removed	Outside vegetation alliance polygon extent
STS-PCUG-2011-1	UN04-2489	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		594108.193	2647465.095	32.633	-108.079	--	263	Y		
STS-PCUG-2011-2	UN04-2490	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		619214.735	2645985.159	32.702	-108.084	--	876	Y		
STS-PCUG-2011-3	UN04-2491	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		618845.199	2648445.179	32.701	-108.076	--	587	Y		
STS-PCUG-2011-4	UN04-2492	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		623951.724	2642920.720	32.715	-108.094	--	794	Y		
STS-PCUG-2011-5	UN04-2493	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		626518.236	2635238.528	32.722	-108.119	--	458	Y		
STS-PCUG-2011-6	UN04-2494	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		614837.725	2650897.204	32.690	-108.068	--	290	Y		
STS-PCUG-2011-7	UN04-2495	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		624003.253	2624159.413	32.715	-108.155	--	387	Y	Removed	Outside vegetation alliance polygon extent

Footnotes:
[1]PreFS RAC for copper for small ground feeding bird applies to 0-6" soil sieved to < 2 mm (2000 µm). Pre-FS RAC for human health applies to 0-1" soil sieved to < 0.25 mm (250 µm). The ratio used to convert copper concentration of 0-1" sieved at <0.25 mm soils to 0-6" sieved at < 2 mm soils is from Appendix A (median ratio of SS samples) of Arcadis (2011). Multiplied copper concentration by 0.7 if outside windblown tailings (and by 1.5 if inside windblown tailings). If unsieved, multiplied by 0.9 if outside windblown tailings and by 1.3 if inside windblown tailings. The 0.9 and 1.3 are from median ratios of unsieved 0-1" soil in 2009 lab reports (at 25 m on transect) compared to sieved 0-6" co-located soil in Drexler lab report in Appendix D of the pH Monitoring Report (Appendix B to the FS Report) for soils in and outside of windblown tailings, respectively (FID 8, 18, 20 in tailings). A subset of the data collected using x-ray fluorescence as part of the Railroad Interim Removal Action (Golder 2013) was collected at 0-2 inch" and sieved at <0.25 mm; the same ratios described here were applied to these data to estimate 0 to 6 inch bgs.
[2]Data were collected for ecological endpoint and were not corrected to human health values.
[3]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as IRA.
[4]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as HWY 180.
[5]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as 2:1 slope.
[6]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as Volcanic Rock.
[7]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as NMDOT.
[8]If two samples were collected from the same location in the same sampling year (with identical sample location coordinates), an average was used in place of the two parent samples. For the co-located samples U04-1121 (SRK 2008) and FID 18 (Arcadis 2009), samples were collected in different years, and the sample from the more recent year was used (FID 18).
*Removed samples with the asterisk are set to 327 for the Theissens analysis. All other removed samples are completely voided.
-- means no data available at the location.

TABLE 3-2
STSIU Surface Soil Copper Results Adjusted to 0-6"

STSIU Feasibility Study
Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Location ID	Alternate ID	Source Report	Year Collected	Original Soil depth	Sieving Status	1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]	Northing (State Plane)	Easting (State Plane)	Latitude	Longitude	Copper Concentration[1] To Compare to HH Pre-FS RAC (250 µm sieve)	Copper Concentration[1] For Bird Pre-FS RAC Analysis (2000 µm sieve)	Pre-Interim Remedial Action (IRA) Dataset	Removed in Post-IRA Dataset	Reason Removed (also see this column's footnotes)
STS-PCUG-2011-8	UN04-2496	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		625787.316	2636466.748	32.720	-108.115	--	449	Y		
STS-PCUG-2011-9	UN04-2497	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		613392.289	2646586.726	32.686	-108.082	--	246	Y		
STS-PCUG-2011-10	UN04-2498	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		595918.228	2651471.037	32.638	-108.066	--	324	Y		
STS-PCUG-2011-11	UN04-2499	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		610116.549	2647194.437	32.677	-108.080	--	254	Y		
STS-PCUG-2011-12	UN04-2500	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		617758.036	2646596.960	32.698	-108.082	--	536	Y		
STS-PCUG-2011-13	UN04-2501	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		623218.874	2645071.913	32.713	-108.087	--	602	Y		
STS-PCUG-2011-14	UN04-2502	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		598476.773	2646243.983	32.645	-108.083	--	354	Y		
STS-PCUG-2011-15	UN04-2503	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		617387.850	2649364.720	32.697	-108.073	--	357	Y		
STS-PCUG-2011-16	UN04-2504	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		624332.059	2636462.881	32.716	-108.115	--	864	Y		
STS-PCUG-2011-17	UN04-2505	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		620319.732	2640451.004	32.705	-108.102	--	994	Y		
STS-PCUG-2011-18	UN04-2506	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		622875.988	2636766.587	32.712	-108.114	--	1540	Y		
STS-PCUG-2011-19	UN04-2507	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		615592.515	2639516.100	32.692	-108.105	--	1210	Y		
STS-PCUG-2011-20	UN04-2508	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		610489.151	2643503.016	32.678	-108.092	--	520	Y		
STS-PCUG-2011-21	UN04-2509	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		621407.311	2641991.700	32.708	-108.097	--	558	Y		
STS-PCUG-2011-22	UN04-2510	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		622899.923	2628154.550	32.712	-108.142	--	976	Y		
STS-PCUG-2011-23	UN04-2511	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		624683.941	2641077.178	32.717	-108.100	--	551	Y		
STS-PCUG-2011-24	UN04-2512	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		622141.939	2639225.296	32.710	-108.106	--	1000	Y		
STS-PCUG-2011-25	UN04-2513	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		621413.523	2639531.011	32.708	-108.105	--	706	Y		
STS-PCUG-2011-27	UN04-2514	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		606856.359	2641340.086	32.668	-108.099	--	438	Y		
STS-PCUG-2011-28	UN04-2516	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		624352.507	2629081.465	32.716	-108.139	--	959	Y		
STS-PCUG-2011-29	UN04-2517	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		625050.089	2640155.437	32.718	-108.103	--	671	Y		
STS-PCUG-2011-30	UN04-2518	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		623623.111	2629694.499	32.714	-108.137	--	1500	Y		
STS-PCUG-2011-31	UN04-2519	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		601024.894	2645634.414	32.652	-108.085	--	304	Y		
STS-PCUG-2011-32	UN04-2520	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		600292.240	2647787.183	32.650	-108.078	--	420	Y		
STS-PCUG-2011-33	UN04-2521	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		599196.609	2649631.439	32.647	-108.072	--	273	Y		
STS-PCUG-2011-34	UN04-2522	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		601746.771	2648098.307	32.654	-108.077	--	364	Y		
STS-PCUG-2011-35	UN04-2523	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		608301.105	2645651.662	32.672	-108.085	--	287	Y		
STS-PCUG-2011-36	UN04-2524	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		608290.486	2650267.303	32.672	-108.070	--	270	Y		
STS-PCUG-2011-37	UN04-2525	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		604296.291	2646873.163	32.661	-108.081	--	244	Y		
STS-PCUG-2011-38	UN04-2526	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		604291.337	2649027.392	32.661	-108.074	--	350	Y		
STS-PCUG-2011-39	UN04-2527	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		605377.956	2651184.024	32.664	-108.067	--	360	Y		
STS-PCUG-2011-40	UN04-2528	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		601377.405	2650559.668	32.653	-108.069	--	312	Y		
STS-PCUG-2011-41	UN04-2529	FS Data Collection, submitted herein	2011	0-6"	2 mm sieve[2]		595928.667	2646853.649	32.638	-108.081	--	587	Y		
29003		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622255.516	2630782.865	32.7102500	-108.1334490	5104	3573	N	Removed*	IRA
29004		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622251.160	2630946.670	32.7102390	-108.1329160	2647	1853	N		
29005		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622244.945	2631112.008	32.7102230	-108.1323790	7635	5344	N	Removed*	IRA
29006		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622241.166	2631277.876	32.7102140	-108.1318390	2855	1999	N	Removed*	IRA
29007		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622236.412	2631441.773	32.7102020	-108.1313060	5707	3995	N	Removed*	IRA
29008		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622231.547	2631606.623	32.7101900	-108.1307700	3668	2568	N	Removed*	IRA
29009		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622226.608	2631772.334	32.7101780	-108.1302320	6471	4530	N	Removed*	IRA
29010		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622221.856	2631936.262	32.7101660	-108.1296990	9945	6961	N	Removed*	IRA
29011		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622386.539	2631942.566	32.7106190	-108.1296800	5569	3898	N	Removed*	IRA
29012		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622548.968	2631947.664	32.7110650	-108.1296650	9918	6943	N	Removed*	IRA
29013		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622714.152	2631943.820	32.7115190	-108.1296780	3938	2757	N		
29014		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622709.586	2632106.792	32.7115080	-108.1291490	3070	2149	N		

Footnotes:
[1]PreFS RAC for copper for small ground feeding bird applies to 0-6" soil sieved to < 2 mm (2000 µm). Pre-FS RAC for human health applies to 0-1" soil sieved to < 0.25 mm (250 µm). The ratio used to convert copper concentration of 0-1" sieved at <0.25 mm soils to 0-6" sieved at < 2 mm soils is from Appendix A (median ratio of SS samples) of Arcadis (2011). Multiplied copper concentration by 0.7 if outside windblown tailings (and by 1.5 if inside windblown tailings). If unsieved, multiplied by 0.9 if outside windblown tailings and by 1.3 if inside windblown tailings. The 0.9 and 1.3 are from median ratios of unsieved 0-1" soil in 2009 lab reports (at 25 m on transect) compared to sieved 0-6" co-located soil in Drexler lab report in Appendix D of the pH Monitoring Report (Appendix B to the FS Report) for soils in and outside of windblown tailings, respectively (FID 8, 18, 20 in tailings). A subset of the data collected using x-ray fluorescence as part of the Railroad Interim Removal Action (Golder 2013) was collected at 0-2 inch" and sieved at <0.25 mm; the same ratios described here were applied to these data to estimate 0 to 6 inch bgs.
[2]Data were collected for ecological endpoint and were not corrected to human health values.
[3]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as IRA.
[4]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as HWY 180.
[5]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as 2:1 slope.
[6]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as Volcanic Rock.
[7]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as NMDOT.
[8]If two samples were collected from the same location in the same sampling year (with identical sample location coordinates), an average was used in place of the two parent samples. For the co-located samples U04-1121 (SRK 2008) and FID 18 (Arcadis 2009), samples were collected in different years, and the sample from the more recent year was used (FID 18).
*Removed samples with the asterisk are set to 327 for the Theissens analysis. All other removed samples are completely voided.
-- means no data available at the location.

TABLE 3-2
STSIU Surface Soil Copper Results Adjusted to 0-6"

STSIU Feasibility Study
Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Location ID	Alternate ID	Source Report	Year Collected	Original Soil depth	Sieving Status	1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]	Northing (State Plane)	Easting (State Plane)	Latitude	Longitude	Copper Concentration[1] To Compare to HH Pre-FS RAC (250 µm sieve)	Copper Concentration[1] For Bird Pre-FS RAC Analysis (2000 µm sieve)	Pre-Interim Remedial Action (IRA) Dataset	Removed in Post-IRA Dataset	Reason Removed (also see this column's footnotes)
29015		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622544.293	2632110.668	32.7110530	-108.1291350	6480	4536	N	Removed*	IRA
29016		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622380.476	2632107.258	32.7106030	-108.1291440	10860	7602	N	Removed*	IRA
29017		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622219.171	2632103.179	32.7101600	-108.1291560	4682	3277	N	Removed*	IRA
29018		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622211.909	2632267.745	32.7101410	-108.1286210	6590	4613	N	Removed*	IRA
29019		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622205.884	2632432.438	32.7101260	-108.1280850	8464	5925	N	Removed*	IRA
29020		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622203.500	2632596.619	32.7101210	-108.1275510	2309	1616	N	Removed*	IRA
29021		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622197.440	2632761.312	32.7101050	-108.1270160	7414	5190	N	Removed*	IRA
29022		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622192.582	2632926.131	32.7100930	-108.1264800	7784	5449	N	Removed*	IRA
29023		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622189.037	2633090.186	32.7100850	-108.1259470	7927	5549	N	Removed*	IRA
29024		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622183.957	2633256.819	32.7100720	-108.1254050	4318	3022	N	Removed*	IRA
29025		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622179.026	2633422.561	32.7100590	-108.1248660	4266	2986	N	Removed*	IRA
29026		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622173.082	2633586.363	32.7100440	-108.1243330	6827	4779	N	Removed*	IRA
29027		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622169.392	2633751.309	32.7100350	-108.1237970	7883	5518	N	Removed*	IRA
29028		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622162.174	2633915.876	32.7100170	-108.1232620	7537	5276	N	Removed*	IRA
29029		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622157.210	2634081.619	32.7100040	-108.1227230	8918	6243	N	Removed*	IRA
29030		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622154.834	2634245.799	32.7099990	-108.1221890	6733	4713	N	Removed*	IRA
29031		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622317.108	2634228.279	32.7104450	-108.1222480	2976	2083	N		
29032		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622480.048	2634233.029	32.7108930	-108.1222340	2589	1812	N		
29033		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622644.332	2634238.705	32.7113450	-108.1222170	1576	1104	N		
29034		Golf Course Interim Removal Action, Arcadis 2009	2012	0-2"	0.25 mm sieve		622809.526	2634244.230	32.7117990	-108.1222000	5,143	3600	N	Removed	Bedrock dust[3]
29035		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622975.531	2634192.487	32.7122550	-108.1223700	1288	902	N		
29036		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622978.958	2634096.718	32.7122630	-108.1226810	2002	1401	N		
29037		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		623140.732	2634088.732	32.7127080	-108.1227090	2144	1501	N		
29038		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622148.551	2634388.839	32.7099830	-108.1217240	3061	2143	N		
29039		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622143.815	2634552.029	32.7099710	-108.1211940	4009	2806	N		
29040		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622139.484	2634673.235	32.7099600	-108.1208000	2552	1786	N		
29059		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622359.348	2632770.988	32.7105500	-108.1269860	8420	5894	N	Removed*	IRA
29060		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622516.821	2632766.318	32.7109830	-108.1270030	3657	2560	N	Removed*	IRA
29061		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622680.415	2632771.569	32.7114330	-108.1269870	10823	7576	N	Removed*	IRA
29062		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622851.286	2632776.687	32.7119020	-108.1269720	10077	7054	N	Removed*	IRA
29063		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		623011.696	2632775.409	32.7123430	-108.1269770	3918	2743	N		
29064		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		623188.304	2632784.387	32.7128290	-108.1269500	3634	2544	N		
29065		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		623339.410	2632805.997	32.7132440	-108.1268810	6705	4693	N	Removed*	IRA
29066		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		623506.680	2632810.735	32.7137040	-108.1268670	1736	1215	N	Removed*	IRA
29067		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		623665.166	2632808.191	32.7141400	-108.1268770	1893	1325	N		
29068		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		623839.973	2632810.490	32.7146200	-108.1268710	1586	1110	N	Removed	IRA, and co-located samples[8]
29069		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		623839.973	2632810.490	32.7146200	-108.1268710	1249	874	N	Removed	Co-located samples[8]
29070		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		623503.194	2632966.110	32.7136960	-108.1263620	1997	1398	N		
29071		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		623498.385	2633113.576	32.7136840	-108.1258820	3975	2783	N		
29072		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		623493.581	2633285.586	32.7136720	-108.1253230	1878	1314	N		
29073		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		623487.156	2633452.271	32.7136550	-108.1247810	1065	746	N		
29074		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		623337.599	2633449.184	32.7132440	-108.1247900	1038	726	N		
29075		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		623175.900	2633442.803	32.7128000	-108.1248090	1909	1336	N		
29076		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		623003.488	2633455.986	32.7123260	-108.1247650	5894	4126	N	Removed*	IRA
29077		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622834.638	2633443.680	32.7118620	-108.1248030	4962	3473	N	Removed*	IRA
29078		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622674.608	2633438.842	32.7114220	-108.1248180	5034	3524	N	Removed*	IRA
29079		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622502.842	2633441.937	32.7109500	-108.1248060	6909	4836	N	Removed*	IRA

Footnotes:
[1]PreFS RAC for copper for small ground feeding bird applies to 0-6" soil sieved to < 2 mm (2000 µm). Pre-FS RAC for human health applies to 0-1" soil sieved to < 0.25 mm (250 µm). The ratio used to convert copper concentration of 0-1" sieved at <0.25 mm soils to 0-6" sieved at < 2 mm soils is from Appendix A (median ratio of SS samples) of Arcadis (2011). Multiplied copper concentration by 0.7 if outside windblown tailings (and by 1.5 if inside windblown tailings). If unsieved, multiplied by 0.9 if outside windblown tailings and by 1.3 if inside windblown tailings. The 0.9 and 1.3 are from median ratios of unsieved 0-1" soil in 2009 lab reports (at 25 m on transect) compared to sieved 0-6" co-located soil in Drexler lab report in Appendix D of the pH Monitoring Report (Appendix B to the FS Report) for soils in and outside of windblown tailings, respectively (FID 8, 18, 20 in tailings). A subset of the data collected using x-ray fluorescence as part of the Railroad Interim Removal Action (Golder 2013) was collected at 0-2 inch" and sieved at <0.25 mm; the same ratios described here were applied to these data to estimate 0 to 6 inch bgs.
[2]Data were collected for ecological endpoint and were not corrected to human health values.
[3]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as IRA.
[4]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as HWY 180.
[5]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as 2:1 slope.
[6]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as Volcanic Rock.
[7]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as NMDOT.
[8]If two samples were collected from the same location in the same sampling year (with identical sample location coordinates), an average was used in place of the two parent samples. For the co-located samples U04-1121 (SRK 2008) and FID 18 (Arcadis 2009), samples were collected in different years, and the sample from the more recent year was used (FID 18).
*Removed samples with the asterisk are set to 327 for the Theissens analysis. All other removed samples are completely voided.
-- means no data available at the location.

TABLE 3-2
STSIU Surface Soil Copper Results Adjusted to 0-6"

STSIU Feasibility Study
Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Location ID	Alternate ID	Source Report	Year Collected	Original Soil depth	Sieving Status	1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]	Northing (State Plane)	Easting (State Plane)	Latitude	Longitude	Copper Concentration[1] To Compare to HH Pre-FS RAC (250 µm sieve)	Copper Concentration[1] For Bird Pre-FS RAC Analysis (2000 µm sieve)	Pre-Interim Remedial Action (IRA) Dataset	Removed in Post-IRA Dataset	Reason Removed (also see this column's footnotes)
29080		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622503.717	2633269.265	32.7109510	-108.1253670	2381	1667	N	Removed*	IRA
29081		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622506.695	2633099.613	32.7109580	-108.1259190	4851	3396	N	Removed*	IRA
29082		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622511.142	2632938.423	32.7109690	-108.1264430	4461	3123	N	Removed*	IRA
29083		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		617663.530	2630616.856	32.6976260	-108.1339460	4188	2932	N		
29084		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		617834.456	2630589.439	32.6980960	-108.1340370	5798	4059	N	Removed*	IRA
29085		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		618001.681	2630584.007	32.6985560	-108.1340560	3587	2511	N	Removed*	IRA
29086		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		618160.916	2630573.969	32.6989930	-108.1340900	4153	2907	N	Removed*	IRA
29087		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		618323.006	2630544.713	32.6994390	-108.1341870	3982	2787	N		
29088		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		618490.383	2630537.066	32.6998990	-108.1342130	4218	2953	N		
29089		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		618658.646	2630537.851	32.7003610	-108.1342120	3954	2768	N	Removed*	IRA
29090		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		618819.982	2630530.834	32.7008040	-108.1342370	5764	4035	N	Removed*	IRA
29091		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		618982.284	2630657.877	32.7012520	-108.1338250	5322	3725	N	Removed*	IRA
29092		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619143.919	2630648.122	32.7016960	-108.1338580	4461	3123	N	Removed*	IRA
29093		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619305.112	2630653.132	32.7021390	-108.1338430	1669	1168	N	Removed*	IRA
29094		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619474.755	2630603.595	32.7026050	-108.1340060	3871	2710	N	Removed*	IRA
29095		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619639.084	2630580.314	32.7030560	-108.1340830	317	222	N	Removed*	IRA
29096		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619804.208	2630571.862	32.7035100	-108.1341120	4746	3322	N	Removed*	IRA
29097		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619967.038	2630551.161	32.7039580	-108.1341810	5994	4196	N	Removed*	IRA
29098		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620132.946	2630535.421	32.7044130	-108.1342340	923	646	N	Removed*	IRA
29099		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620299.953	2630466.223	32.7048720	-108.1344600	7407	5185	N	Removed*	IRA
29100		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620461.668	2630466.621	32.7053160	-108.1344600	6698	4689	N	Removed*	IRA
29101		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620627.769	2630460.141	32.7057730	-108.1344830	8099	5669	N	Removed*	IRA
29102		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620791.911	2630438.676	32.7062240	-108.1345540	5685	3979	N	Removed*	IRA
29103		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620954.224	2630433.631	32.7066700	-108.1345720	8989	6292	N	Removed*	IRA
29104		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621123.238	2630400.676	32.7071340	-108.1346810	12366	8656	N	Removed*	IRA
29105		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621289.338	2630394.196	32.7075910	-108.1347040	9223	6456	N	Removed*	IRA
29106		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621287.210	2630259.988	32.7075840	-108.1351400	7427	5199	N	Removed*	IRA
29107		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621123.804	2630252.910	32.7071350	-108.1351610	7638	5347	N	Removed*	IRA
29108		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620960.456	2630289.264	32.7066860	-108.1350420	3256	2280	N	Removed*	IRA
29109		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620794.158	2630275.411	32.7062290	-108.1350850	7703	5392	N	Removed*	IRA
29110		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620631.332	2630307.183	32.7057820	-108.1349800	9264	6485	N	Removed*	IRA
29111		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620467.569	2630336.093	32.7053320	-108.1348850	8572	6000	N	Removed*	IRA
29112		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620299.751	2630358.101	32.7048700	-108.1348120	6444	4511	N	Removed*	IRA
29113		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620136.536	2630360.283	32.7044220	-108.1348030	9780	6846	N	Removed*	IRA
29114		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619974.683	2630382.954	32.7039770	-108.1347280	7914	5540	N	Removed*	IRA
29115		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619808.288	2630403.245	32.7035200	-108.1346600	10742	7520	N	Removed*	IRA
29116		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619640.246	2630427.068	32.7030580	-108.1345810	6245	4372	N	Removed*	IRA
29117		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619477.827	2630444.110	32.7026120	-108.1345240	7341	5139	N	Removed*	IRA
29118		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619312.948	2630417.464	32.7021590	-108.1346100	2501	1750	N	Removed*	IRA
29119		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619152.214	2630430.111	32.7017170	-108.1345670	4832	3382	N	Removed*	IRA
29120		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		618988.286	2630427.585	32.7012660	-108.1345740	2414	1690	N	Removed*	IRA
29121		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		618826.192	2630419.742	32.7008210	-108.1345980	6236	4365	N	Removed*	IRA
29122		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		618660.166	2630425.299	32.7003640	-108.1345780	5250	3675	N	Removed*	IRA
29123		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		618493.578	2630424.242	32.6999060	-108.1345800	5004	3503	N	Removed*	IRA
29124		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		618333.839	2630419.696	32.6994670	-108.1345930	4588	3212	N		
29125		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		618168.150	2630409.413	32.6990120	-108.1346250	7673	5371	N	Removed*	IRA
29126		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		618003.250	2630416.020	32.6985590	-108.1346020	4807	3365	N	Removed*	IRA

Footnotes:
[1]PreFS RAC for copper for small ground feeding bird applies to 0-6" soil sieved to < 2 mm (2000 µm). Pre-FS RAC for human health applies to 0-1" soil sieved to < 0.25 mm (250 µm). The ratio used to convert copper concentration of 0-1" sieved at <0.25 mm soils to 0-6" sieved at < 2 mm soils is from Appendix A (median ratio of SS samples) of Arcadis (2011). Multiplied copper concentration by 0.7 if outside windblown tailings (and by 1.5 if inside windblown tailings). If unsieved, multiplied by 0.9 if outside windblown tailings and by 1.3 if inside windblown tailings. The 0.9 and 1.3 are from median ratios of unsieved 0-1" soil in 2009 lab reports (at 25 m on transect) compared to sieved 0-6" co-located soil in Drexler lab report in Appendix D of the pH Monitoring Report (Appendix B to the FS Report) for soils in and outside of windblown tailings, respectively (FID 8, 18, 20 in tailings). A subset of the data collected using x-ray fluorescence as part of the Railroad Interim Removal Action (Golder 2013) was collected at 0-2 inch" and sieved at <0.25 mm; the same ratios described here were applied to these data to estimate 0 to 6 inch bgs.
[2]Data were collected for ecological endpoint and were not corrected to human health values.
[3]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as IRA.
[4]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as HWY 180.
[5]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as 2:1 slope.
[6]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as Volcanic Rock.
[7]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as NMDOT.
[8]If two samples were collected from the same location in the same sampling year (with identical sample location coordinates), an average was used in place of the two parent samples. For the co-located samples U04-1121 (SRK 2008) and FID 18 (Arcadis 2009), samples were collected in different years, and the sample from the more recent year was used (FID 18).
*Removed samples with the asterisk are set to 327 for the Theissens analysis. All other removed samples are completely voided.
-- means no data available at the location.

TABLE 3-2
STSIU Surface Soil Copper Results Adjusted to 0-6"

STSIU Feasibility Study
Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Location ID	Alternate ID	Source Report	Year Collected	Original Soil depth	Sieving Status	1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]	Northing (State Plane)	Easting (State Plane)	Latitude	Longitude	Copper Concentration[1] To Compare to HH Pre-FS RAC (250 µm sieve)	Copper Concentration[1] For Bird Pre-FS RAC Analysis (2000 µm sieve)	Pre-Interim Remedial Action (IRA) Dataset	Removed in Post-IRA Dataset	Reason Removed (also see this column's footnotes)
29127		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		617840.228	2630427.462	32.6981110	-108.1345630	4870	3409	N	Removed*	IRA
29128		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		617674.617	2630466.398	32.6976560	-108.1344350	3718	2603	N	Removed*	IRA
29129		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		617505.542	2630598.105	32.6971920	-108.1340060	3223	2256	N		
29130		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621985.078	2634406.141	32.7095340	-108.1216670	2692	1885	N	Removed*	IRA
29131		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621990.040	2634240.398	32.7095460	-108.1222050	3402	2381	N	Removed*	IRA
29132		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622321.155	2634064.965	32.7104550	-108.1227790	4877	3414	N		
29133		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622327.044	2633920.326	32.7104700	-108.1232490	8353	5847	N	Removed*	IRA
29134		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622331.933	2633755.507	32.7104820	-108.1237850	6237	4366	N	Removed*	IRA
29135		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622336.788	2633590.688	32.7104940	-108.1243210	4701	3291	N	Removed*	IRA
29136		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622500.381	2633595.935	32.7109440	-108.1243050	4632	3242	N	Removed*	IRA
29137		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622992.475	2633610.880	32.7122970	-108.1242610	5613	3929	N	Removed*	IRA
29138		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		623002.297	2633280.327	32.7123210	-108.1253360	10154	7108	N	Removed*	IRA
29139		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622684.712	2632941.087	32.7114460	-108.1264360	8205	5743	N	Removed*	IRA
29140		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622529.635	2632606.074	32.7110170	-108.1275240	8262	5784	N	Removed*	IRA
29141		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622365.930	2632601.714	32.7105670	-108.1275360	7622	5335	N	Removed*	IRA
29142		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622370.753	2632436.895	32.7105790	-108.1280720	7950	5565	N	Removed*	IRA
29143		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		623338.692	2632947.232	32.7132430	-108.1264220	4782	3348	N		
29144		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		623348.513	2632619.481	32.7132680	-108.1274880	3300	2310	N		
29145		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622375.614	2632272.077	32.7105910	-108.1286080	11757	8230	N	Removed*	IRA
29146		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622539.320	2632276.408	32.7110410	-108.1285960	2560	1792	N	Removed*	IRA
29147		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622390.202	2631777.590	32.7106270	-108.1302160	9863	6904	N	Removed*	IRA
29148		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622553.907	2631781.924	32.7110770	-108.1302030	10242	7169	N	Removed*	IRA
29149		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622558.532	2631611.723	32.7110890	-108.1307570	5163	3614	N	Removed*	IRA
29150		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622394.646	2631606.834	32.7106380	-108.1307710	5034	3524	N	Removed*	IRA
29151		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622399.545	2631442.939	32.7106500	-108.1313040	5229	3660	N	Removed*	IRA
29152		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622404.444	2631279.074	32.7106630	-108.1318370	1521	1065	N		
29153		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622409.345	2631115.179	32.7106750	-108.1323700	851	596	N		
29154		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621758.808	2630933.252	32.7088850	-108.1329550	6329	4430	N	Removed*	IRA
29155		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621923.602	2630938.639	32.7093380	-108.1329390	7790	5453	N	Removed*	IRA
29156		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622086.474	2630941.530	32.7097860	-108.1329310	4947	3463	N		
29157		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622082.440	2631107.797	32.7097760	-108.1323910	6843	4790	N	Removed*	IRA
29158		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621918.734	2631103.460	32.7093260	-108.1324030	4033	2823	N	Removed*	IRA
29159		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621753.940	2631098.074	32.7088730	-108.1324190	7202	5042	N	Removed*	IRA
29160		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621442.259	2630545.011	32.7080120	-108.1342150	3650	2555	N		
29161		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621277.719	2630565.645	32.7075600	-108.1341460	2824	1977	N	Removed*	IRA
29162		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621112.867	2630593.537	32.7071070	-108.1340540	3095	2167	N	Removed*	IRA
29163		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620948.431	2630628.844	32.7066560	-108.1339380	4117	2882	N	Removed*	IRA
29164		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620783.089	2630650.184	32.7062010	-108.1338670	2499	1749	N	Removed*	IRA
29165		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620618.903	2630661.499	32.7057500	-108.1338280	1461	1023	N	Removed*	IRA
29166		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620453.859	2630680.103	32.7052970	-108.1337660	3510	2457	N	Removed*	IRA
29167		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621606.655	2630549.568	32.7084640	-108.1342010	7525	5268	N	Removed*	IRA
29168		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621609.786	2630433.494	32.7084720	-108.1345790	3710	2597	N	Removed*	IRA
29169		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621773.379	2630438.757	32.7089220	-108.1345630	5386	3770	N	Removed*	IRA
29170		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621938.285	2630443.224	32.7093750	-108.1345500	5878	4114	N	Removed*	IRA
29171		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622103.100	2630415.364	32.7098280	-108.1346420	8752	6126	N	Removed*	IRA
29172		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622266.035	2630422.009	32.7102760	-108.1346220	2825	1978	N	Removed*	IRA
29173		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622269.973	2630290.929	32.7102850	-108.1350480	1365	956	N		

Footnotes:
[1]PreFS RAC for copper for small ground feeding bird applies to 0-6" soil sieved to < 2 mm (2000 µm). Pre-FS RAC for human health applies to 0-1" soil sieved to < 0.25 mm (250 µm). The ratio used to convert copper concentration of 0-1" sieved at <0.25 mm soils to 0-6" sieved at < 2 mm soils is from Appendix A (median ratio of SS samples) of Arcadis (2011). Multiplied copper concentration by 0.7 if outside windblown tailings (and by 1.5 if inside windblown tailings). If unsieved, multiplied by 0.9 if outside windblown tailings and by 1.3 if inside windblown tailings. The 0.9 and 1.3 are from median ratios of unsieved 0-1" soil in 2009 lab reports (at 25 m on transect) compared to sieved 0-6" co-located soil in Drexler lab report in Appendix D of the pH Monitoring Report (Appendix B to the FS Report) for soils in and outside of windblown tailings, respectively (FID 8, 18, 20 in tailings). A subset of the data collected using x-ray fluorescence as part of the Railroad Interim Removal Action (Golder 2013) was collected at 0-2 inch" and sieved at <0.25 mm; the same ratios described here were applied to these data to estimate 0 to 6 inch bgs.
[2]Data were collected for ecological endpoint and were not corrected to human health values.
[3]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as IRA.
[4]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as HWY 180.
[5]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as 2:1 slope.
[6]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as Volcanic Rock.
[7]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as NMDOT.
[8]If two samples were collected from the same location in the same sampling year (with identical sample location coordinates), an average was used in place of the two parent samples. For the co-located samples U04-1121 (SRK 2008) and FID 18 (Arcadis 2009), samples were collected in different years, and the sample from the more recent year was used (FID 18).
*Removed samples with the asterisk are set to 327 for the Theissens analysis. All other removed samples are completely voided.
-- means no data available at the location.

TABLE 3-2
STSIU Surface Soil Copper Results Adjusted to 0-6"

STSIU Feasibility Study
Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Location ID	Alternate ID	Source Report	Year Collected	Original Soil depth	Sieving Status	1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]	Northing (State Plane)	Easting (State Plane)	Latitude	Longitude	Copper Concentration[1] To Compare to HH Pre-FS RAC (250 µm sieve)	Copper Concentration[1] For Bird Pre-FS RAC Analysis (2000 µm sieve)	Pre-Interim Remedial Action (IRA) Dataset	Removed in Post-IRA Dataset	Reason Removed (also see this column's footnotes)
29174		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622106.749	2630283.667	32.7098370	-108.1350700	5649	3955	N	Removed*	IRA
29175		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621942.202	2630281.108	32.7093840	-108.1350770	3141	2199	N		
29176		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621778.316	2630276.212	32.7089340	-108.1350920	3908	2736	N		
29177		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621614.467	2630271.316	32.7084830	-108.1351060	3254	2278	N		
29178		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620309.083	2630032.103	32.7048940	-108.1358720	8628	6039	N	Removed*	IRA
29179		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620144.861	2630043.385	32.7044420	-108.1358330	6062	4243	N	Removed*	IRA
29180		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619980.526	2630055.620	32.7039910	-108.1357920	3840	2688	N	Removed*	IRA
29181		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619816.933	2630050.355	32.7035410	-108.1358080	1353	947	N	Removed*	IRA
29182		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619653.228	2630046.012	32.7030910	-108.1358200	2134	1494	N	Removed*	IRA
29183		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619488.434	2630040.651	32.7026380	-108.1358360	1585	1110	N	Removed*	IRA
29184		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619324.805	2630035.386	32.7021880	-108.1358520	3772	2641	N	Removed*	IRA
29185		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619161.100	2630031.043	32.7017380	-108.1358640	3335	2335	N	Removed*	IRA
29186		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		618997.506	2630025.808	32.7012880	-108.1358800	7712	5399	N	Removed*	IRA
29187		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619002.221	2629865.217	32.7013000	-108.1364020	1926	1349	N		
29188		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619166.107	2629870.115	32.7017510	-108.1363880	1758	1231	N		
29189		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619171.014	2629706.234	32.7017630	-108.1369200	2052	1436	N		
29190		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619334.551	2629705.718	32.7022120	-108.1369240	6985	4890	N	Removed*	IRA
29191		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619339.771	2629547.253	32.7022250	-108.1374390	3540	2478	N		
29192		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619503.656	2629552.152	32.7026760	-108.1374240	3989	2792	N		
29193		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619667.542	2629557.052	32.7031270	-108.1374100	4509	3156	N		
29194		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619672.049	2629406.277	32.7031380	-108.1379000	4425	3098	N		
29195		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619831.391	2629561.951	32.7035770	-108.1373960	3977	2784	N		
29196		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619990.272	2629725.959	32.7040150	-108.1368640	8377	5864	N	Removed*	IRA
29197		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619826.643	2629720.692	32.7035650	-108.1368800	1900	1330	N	Removed*	IRA
29198		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619663.049	2629715.456	32.7031150	-108.1368950	7462	5223	N	Removed*	IRA
29199		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619498.144	2629710.985	32.7026620	-108.1369080	7500	5250	N	Removed*	IRA
29200		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619329.677	2629870.552	32.7022000	-108.1363880	4178	2925	N	Removed*	IRA
29201		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619493.307	2629875.818	32.7026500	-108.1363720	6403	4482	N	Removed*	IRA
29202		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619658.101	2629881.180	32.7031030	-108.1363560	6826	4778	N	Removed*	IRA
29203		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619821.806	2629885.524	32.7035530	-108.1363440	7434	5204	N	Removed*	IRA
29204		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619985.399	2629890.790	32.7040030	-108.1363280	5646	3953	N	Removed*	IRA
29208		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620303.560	2630246.730	32.7048800	-108.1351740	10134	7094	N	Removed*	IRA
29209		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620139.337	2630258.044	32.7044290	-108.1351360	9863	6904	N	Removed*	IRA
29210		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619974.432	2630253.576	32.7039750	-108.1351480	10619	7433	N	Removed*	IRA
29211		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619809.617	2630281.437	32.7035230	-108.1350560	1592	1114	N	Removed*	IRA
29212		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619646.478	2630282.726	32.7030740	-108.1350510	7807	5465	N	Removed*	IRA
29213		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619480.980	2630294.806	32.7026190	-108.1350100	4540	3178	N	Removed*	IRA
29214		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619317.685	2630286.805	32.7021710	-108.1350340	5320	3724	N	Removed*	IRA
29215		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619153.463	2630298.119	32.7017190	-108.1349960	1192	835	N	Removed*	IRA
29216		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		618988.830	2630313.093	32.7012670	-108.1349460	3039	2127	N	Removed*	IRA
29217		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		618824.906	2630321.640	32.7008160	-108.1349170	7887	5521	N	Removed*	IRA
29218		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		618660.683	2630332.955	32.7003650	-108.1348780	7068	4948	N	Removed*	IRA
29219		Golf Course Interim Removal Action, Arcadis 2009	2012	0-2"	0.25 mm sieve		618496.085	2630335.593	32.6999130	-108.1348680	5,017	3512	N	Removed	Bedrock dust[4]
29220		Golf Course Interim Removal Action, Arcadis 2009	2012	0-2"	0.25 mm sieve		618331.753	2630347.062	32.6994610	-108.1348290	5,231	3662	N	Removed	Bedrock dust[4]
29221		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621373.790	2629982.020	32.7078200	-108.1360440	3552	2486	N		
29222		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621294.879	2629981.856	32.7076030	-108.1360440	6701	4691	N	Removed*	IRA
29223		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621131.664	2629984.036	32.7071540	-108.1360360	2379	1665	N	Removed*	IRA

Footnotes:
[1]PreFS RAC for copper for small ground feeding bird applies to 0-6" soil sieved to < 2 mm (2000 µm). Pre-FS RAC for human health applies to 0-1" soil sieved to < 0.25 mm (250 µm). The ratio used to convert copper concentration of 0-1" sieved at <0.25 mm soils to 0-6" sieved at < 2 mm soils is from Appendix A (median ratio of SS samples) of Arcadis (2011). Multiplied copper concentration by 0.7 if outside windblown tailings (and by 1.5 if inside windblown tailings). If unsieved, multiplied by 0.9 if outside windblown tailings and by 1.3 if inside windblown tailings. The 0.9 and 1.3 are from median ratios of unsieved 0-1" soil in 2009 lab reports (at 25 m on transect) compared to sieved 0-6" co-located soil in Drexler lab report in Appendix D of the pH Monitoring Report (Appendix B to the FS Report) for soils in and outside of windblown tailings, respectively (FID 8, 18, 20 in tailings). A subset of the data collected using x-ray fluorescence as part of the Railroad Interim Removal Action (Golder 2013) was collected at 0-2 inch" and sieved at <0.25 mm; the same ratios described here were applied to these data to estimate 0 to 6 inch bgs.
[2]Data were collected for ecological endpoint and were not corrected to human health values.
[3]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as IRA.
[4]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as HWY 180.
[5]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as 2:1 slope.
[6]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as Volcanic Rock.
[7]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as NMDOT.
[8]If two samples were collected from the same location in the same sampling year (with identical sample location coordinates), an average was used in place of the two parent samples. For the co-located samples U04-1121 (SRK 2008) and FID 18 (Arcadis 2009), samples were collected in different years, and the sample from the more recent year was used (FID 18).
*Removed samples with the asterisk are set to 327 for the Theissens analysis. All other removed samples are completely voided.
-- means no data available at the location.

TABLE 3-2
STSIU Surface Soil Copper Results Adjusted to 0-6"

STSIU Feasibility Study
Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Location ID	Alternate ID	Source Report	Year Collected	Original Soil depth	Sieving Status	1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]	Northing (State Plane)	Easting (State Plane)	Latitude	Longitude	Copper Concentration[1] To Compare to HH Pre-FS RAC (250 µm sieve)	Copper Concentration[1] For Bird Pre-FS RAC Analysis (2000 µm sieve)	Pre-Interim Remedial Action (IRA) Dataset	Removed in Post-IRA Dataset	Reason Removed (also see this column's footnotes)
29224		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620967.067	2629998.976	32.7067020	-108.1359850	8174	5722	N	Removed*	IRA
29225		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620801.943	2630007.425	32.7062480	-108.1359560	7557	5290	N	Removed*	IRA
29226		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620637.865	2630019.045	32.7057970	-108.1359170	1999	1400	N		
29227		Golf Course Interim Removal Action, Arcadis 2009	2012	0-2"	0.25 mm sieve		620473.378	2630033.833	32.7053450	-108.1358680	5,841	4089	N	Removed	Bedrock dust[7]
29228		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620149.104	2629895.133	32.7044530	-108.1363150	9813	6869	N	Removed*	IRA
29229		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620313.897	2629900.526	32.7049060	-108.1362990	6472	4530	N	Removed*	IRA
29230		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620477.117	2629909.266	32.7053540	-108.1362730	4378	3065	N		
29231		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620641.002	2629914.164	32.7058050	-108.1362580	4311	3018	N		
29232		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620804.937	2629914.448	32.7062560	-108.1362590	6505	4553	N	Removed*	IRA
29233		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620968.531	2629919.683	32.7067050	-108.1362430	7280	5096	N	Removed*	IRA
29234		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621133.436	2629924.183	32.7071590	-108.1362300	3475	2432	N	Removed*	IRA
29235		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621296.508	2629933.785	32.7076070	-108.1362000	4989	3492	N		
29236		Golf Course Interim Removal Action, Arcadis 2009	2012	0-2"	0.25 mm sieve		621404.661	2629937.016	32.7079040	-108.1361910	5,138	3597	N	Removed	Bedrock dust[5]
29237		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620154.253	2629735.595	32.7044660	-108.1368340	4718	3302	N		
29238		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620318.139	2629740.494	32.7049160	-108.1368200	2834	1984	N		
29239		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620482.024	2629745.392	32.7053670	-108.1368050	4791	3354	N		
29240		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620645.873	2629750.290	32.7058170	-108.1367910	4044	2831	N		
29241		Golf Course Interim Removal Action, Arcadis 2009	2012	0-2"	0.25 mm sieve		620809.759	2629755.189	32.7062680	-108.1367760	5,442	3809	N	Removed	Bedrock dust[6]
29242		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620973.644	2629760.087	32.7067180	-108.1367620	2697	1888	N		
29243		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621137.529	2629764.985	32.7071690	-108.1367480	2735	1914	N		
29244		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621301.379	2629769.884	32.7076190	-108.1367330	4002	2802	N		
29245		Golf Course Interim Removal Action, Arcadis 2009	2012	0-2"	0.25 mm sieve		621389.888	2629772.536	32.7078620	-108.1367250	5,278	3695	N	Removed	Bedrock dust[5]
29246		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622861.786	2632440.905	32.7119290	-108.1280640	3206	2244	N		
29247		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		623020.741	2632609.682	32.7123670	-108.1275160	3748	2624	N		
29248		Golf Course Interim Removal Action, Arcadis 2009	2012	0-2"	0.25 mm sieve		622489.927	2633905.977	32.7109180	-108.1232970	5,152	3606	N	Removed	Bedrock dust[3]
29249		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622495.527	2633760.753	32.7109320	-108.1237690	3505	2454	N	Removed*	IRA
29250		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622659.233	2633765.077	32.7113820	-108.1237570	5047	3533	N	Removed*	IRA
29251		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622653.813	2633910.885	32.7113680	-108.1232830	3329	2330	N		
29252		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622812.777	2634079.656	32.7118060	-108.1227350	4420	3094	N		
29253		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622817.699	2633915.762	32.7118190	-108.1232680	1720	1204	N		
29254		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622824.027	2633770.481	32.7118350	-108.1237410	4100	2870	N	Removed*	IRA
29255		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622828.881	2633605.633	32.7118470	-108.1242770	5559	3891	N	Removed*	IRA
29256		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622664.087	2633600.260	32.7113940	-108.1242930	5373	3761	N	Removed*	IRA
29257		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622987.621	2633775.727	32.7122850	-108.1237250	6049	4234	N	Removed*	IRA
29258		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622982.768	2633940.542	32.7122730	-108.1231890	5872	4110	N	Removed*	IRA
29259		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		623150.322	2633761.686	32.7127320	-108.1237720	1273	891	N		
29260		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		623155.246	2633597.825	32.7127440	-108.1243050	829	581	N		
29261		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621502.686	2634061.531	32.7082050	-108.1227830	6816	4771	N	Removed*	IRA
29262		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621497.835	2634226.354	32.7081930	-108.1222470	8656	6059	N	Removed*	IRA
29263		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621492.984	2634391.177	32.7081810	-108.1217110	7501	5251	N	Removed*	IRA
29264		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621488.134	2634556.031	32.7081690	-108.1211750	5986	4190	N	Removed*	IRA
29265		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621651.728	2634561.274	32.7086190	-108.1211590	1973	1381	N	Removed*	IRA
29266		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621646.074	2634700.841	32.7086040	-108.1207050	2268	1588	N	Removed*	IRA
29267		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621815.433	2634565.594	32.7090690	-108.1211470	6226	4358	N	Removed*	IRA
29268		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621656.689	2634395.529	32.7086310	-108.1216980	5890	4123	N	Removed*	IRA
29269		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621820.283	2634400.772	32.7090810	-108.1216830	5580	3906	N	Removed*	IRA
29270		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621825.134	2634235.950	32.7090930	-108.1222180	6999	4899	N	Removed*	IRA

Footnotes:
[1]PreFS RAC for copper for small ground feeding bird applies to 0-6" soil sieved to < 2 mm (2000 µm). Pre-FS RAC for human health applies to 0-1" soil sieved to < 0.25 mm (250 µm). The ratio used to convert copper concentration of 0-1" sieved at <0.25 mm soils to 0-6" sieved at < 2 mm soils is from Appendix A (median ratio of SS samples) of Arcadis (2011). Multiplied copper concentration by 0.7 if outside windblown tailings (and by 1.5 if inside windblown tailings). If unsieved, multiplied by 0.9 if outside windblown tailings and by 1.3 if inside windblown tailings. The 0.9 and 1.3 are from median ratios of unsieved 0-1" soil in 2009 lab reports (at 25 m on transect) compared to sieved 0-6" co-located soil in Drexler lab report in Appendix D of the pH Monitoring Report (Appendix B to the FS Report) for soils in and outside of windblown tailings, respectively (FID 8, 18, 20 in tailings). A subset of the data collected using x-ray fluorescence as part of the Railroad Interim Removal Action (Golder 2013) was collected at 0-2 inch" and sieved at <0.25 mm; the same ratios described here were applied to these data to estimate 0 to 6 inch bgs.
[2]Data were collected for ecological endpoint and were not corrected to human health values.
[3]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as IRA.
[4]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as HWY 180.
[5]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as 2:1 slope.
[6]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as Volcanic Rock.
[7]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as NMDOT.
[8]If two samples were collected from the same location in the same sampling year (with identical sample location coordinates), an average was used in place of the two parent samples. For the co-located samples U04-1121 (SRK 2008) and FID 18 (Arcadis 2009), samples were collected in different years, and the sample from the more recent year was used (FID 18).
*Removed samples with the asterisk are set to 327 for the Theissens analysis. All other removed samples are completely voided.
-- means no data available at the location.

TABLE 3-2
STSIU Surface Soil Copper Results Adjusted to 0-6"

STSIU Feasibility Study
Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Location ID	Alternate ID	Source Report	Year Collected	Original Soil depth	Sieving Status	1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]	Northing (State Plane)	Easting (State Plane)	Latitude	Longitude	Copper Concentration[1]		Pre-Interim Remedial Action (IRA) Dataset	Removed in Post-IRA Dataset	Reason Removed (also see this column's footnotes)
											To Compare to HH Pre-FS RAC (250 µm sieve)	For Bird Pre-FS RAC Analysis (2000 µm sieve)			
29271		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621661.540	2634230.706	32.7086430	-108.1222340	4587	3211	N	Removed*	IRA
29272		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621666.392	2634065.884	32.7086550	-108.1227700	3737	2616	N	Removed*	IRA
29273		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621829.986	2634071.129	32.7091050	-108.1227540	7544	5281	N	Removed*	IRA
29274		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621994.892	2634075.578	32.7095580	-108.1227410	8694	6086	N	Removed*	IRA
29309		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		616830.497	2631184.661	32.6953410	-108.1320930	2,468	1728	N	Removed*	IRA
29310		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		616812.643	2631013.536	32.6952910	-108.1326490	2,715	1901	N	Removed*	IRA
29311		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		616781.494	2630848.588	32.6952040	-108.1331850	518	363	N	Removed*	IRA
29312		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		616766.715	2630684.116	32.6951620	-108.1337190	592	414	N	Removed*	IRA
29313		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		616801.121	2630521.138	32.6952550	-108.1342490	857	600	N	Removed*	IRA
29314		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		616655.092	2630467.564	32.6948540	-108.1344220	652	456	N	Removed*	IRA
29315		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		616650.225	2630631.427	32.6948410	-108.1338890	408	286	N	Removed*	IRA
29316		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		616645.322	2630795.321	32.6948290	-108.1333570	209	146	N	Removed*	IRA
29317		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		616640.421	2630959.184	32.6948170	-108.1328240	2,060	1442	N	Removed*	IRA
29318		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		616635.238	2631132.890	32.6948040	-108.1322590	2,563	1794	N	Removed*	IRA
29319		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		616469.185	2631200.102	32.6943480	-108.1320390	3,569	2498	N	Removed*	IRA
29320		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		616305.135	2631201.763	32.6938970	-108.1320320	3,780	2646	N	Removed*	IRA
29321		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		616140.449	2631223.080	32.6934450	-108.1319620	2,641	1849	N	Removed*	IRA
29322		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		615976.281	2631228.032	32.6929940	-108.1319440	1,540	1078	N	Removed*	IRA
29323		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		615811.749	2631246.058	32.6925410	-108.1318840	1,529	1070	N	Removed*	IRA
29324		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		615647.181	2631264.115	32.6920890	-108.1318240	3,605	2524	N	Removed*	IRA
29325		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		615483.013	2631269.068	32.6916380	-108.1318060	2,088	1462	N	Removed*	IRA
29326		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		615318.445	2631287.094	32.6911860	-108.1317460	2,648	1854	N	Removed*	IRA
29327		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		615153.877	2631305.152	32.6907340	-108.1316860	2,306	1614	N	Removed*	IRA
29328		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		615323.545	2631116.673	32.6911990	-108.1323000	1,330	931	N	Removed*	IRA
29329		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		615487.394	2631121.564	32.6916490	-108.1322860	2,432	1702	N	Removed*	IRA
29330		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		615652.163	2631096.956	32.6921020	-108.1323670	1,984	1389	N	Removed*	IRA
29331		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		615816.649	2631082.191	32.6925540	-108.1324170	1,120	784	N	Removed*	IRA
29332		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		615980.899	2631073.979	32.6930050	-108.1324450	1,571	1100	N	Removed*	IRA
29333		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		616145.349	2631059.214	32.6934570	-108.1324940	1,971	1380	N	Removed*	IRA
29334		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		616309.717	2631047.711	32.6939090	-108.1325330	964	675	N	Removed*	IRA
29335		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		616474.085	2631036.238	32.6943600	-108.1325720	2,449	1714	N	Removed*	IRA
29336		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		615325.996	2631034.722	32.6912050	-108.1325660	2,025	1418	N	Removed*	IRA
29337		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		615493.780	2630908.538	32.6916650	-108.1329780	1,017	712	N	Removed*	IRA
29338		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		615657.665	2630913.431	32.6921150	-108.1329640	550	385	N	Removed*	IRA
29339		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		615821.514	2630918.324	32.6925660	-108.1329490	1,572	1100	N	Removed*	IRA
29340		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		615985.399	2630923.217	32.6930160	-108.1329350	1,943	1360	N	Removed*	IRA
29341		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		616150.250	2630895.349	32.6934690	-108.1330270	2,965	2076	N	Removed*	IRA
29342		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		616314.618	2630883.846	32.6939210	-108.1330660	424	297	N	Removed*	IRA
29343		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		616479.105	2630869.083	32.6943730	-108.1331150	427	299	N	Removed*	IRA
29344		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		616483.888	2630708.480	32.6943850	-108.1336380	333	233	N	Removed*	IRA
29345		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		616488.791	2630544.617	32.6943970	-108.1341700	533	373	N	Removed*	IRA
29346		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		616319.520	2630719.982	32.6939330	-108.1335990	359	251	N	Removed*	IRA
29347		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		616324.423	2630556.087	32.6939450	-108.1341310	508	356	N	Removed*	IRA
29348		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		616155.152	2630731.453	32.6934810	-108.1335600	486	340	N	Removed*	IRA
29349		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		616160.055	2630567.588	32.6934940	-108.1340920	1,493	1045	N	Removed*	IRA
29350		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		615990.301	2630759.351	32.6930280	-108.1334680	1,191	834	N	Removed*	IRA
29351		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		615995.204	2630595.454	32.6930410	-108.1340000	1,242	869	N	Removed*	IRA

Footnotes:
[1]PreFS RAC for copper for small ground feeding bird applies to 0-6" soil sieved to < 2 mm (2000 µm). Pre-FS RAC for human health applies to 0-1" soil sieved to < 0.25 mm (250 µm). The ratio used to convert copper concentration of 0-1" sieved at <0.25 mm soils to 0-6" sieved at < 2 mm soils is from Appendix A (median ratio of SS samples) of Arcadis (2011). Multiplied copper concentration by 0.7 if outside windblown tailings (and by 1.5 if inside windblown tailings). If unsieved, multiplied by 0.9 if outside windblown tailings and by 1.3 if inside windblown tailings. The 0.9 and 1.3 are from median ratios of unsieved 0-1" soil in 2009 lab reports (at 25 m on transect) compared to sieved 0-6" co-located soil in Drexler lab report in Appendix D of the pH Monitoring Report (Appendix B to the FS Report) for soils in and outside of windblown tailings, respectively (FID 8, 18, 20 in tailings). A subset of the data collected using x-ray fluorescence as part of the Railroad Interim Removal Action (Golder 2013) was collected at 0-2 inch" and sieved at <0.25 mm; the same ratios described here were applied to these data to estimate 0 to 6 inch bgs.
[2]Data were collected for ecological endpoint and were not corrected to human health values.
[3]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as IRA.
[4]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as HWY 180.
[5]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as 2:1 slope.
[6]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as Volcanic Rock.
[7]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as NMDOT.
[8]If two samples were collected from the same location in the same sampling year (with identical sample location coordinates), an average was used in place of the two parent samples. For the co-located samples U04-1121 (SRK 2008) and FID 18 (Arcadis 2009), samples were collected in different years, and the sample from the more recent year was used (FID 18).
*Removed samples with the asterisk are set to 327 for the Theissens analysis. All other removed samples are completely voided.
-- means no data available at the location.

TABLE 3-2
STSIU Surface Soil Copper Results Adjusted to 0-6"

STSIU Feasibility Study
Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Location ID	Alternate ID	Source Report	Year Collected	Original Soil depth	Sieving Status	1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]	Northing (State Plane)	Easting (State Plane)	Latitude	Longitude	Copper Concentration[1] To Compare to HH Pre-FS RAC (250 µm sieve)	Copper Concentration[1] For Bird Pre-FS RAC Analysis (2000 µm sieve)	Pre-Interim Remedial Action (IRA) Dataset	Removed in Post-IRA Dataset	Reason Removed (also see this column's footnotes)
29352		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		615826.416	2630754.457	32.6925780	-108.1334820	2,685	1880	N	Removed*	IRA
29353		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		615662.366	2630756.116	32.6921270	-108.1334750	1,508	1056	N	Removed*	IRA
1001-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621252.046	2633228.538	32.7075100	-108.1254890	235	165	N		
1002-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621251.513	2633078.709	32.7075070	-108.1259760	110	77	N		
1003-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621251.127	2632928.696	32.7075050	-108.1264630	2908	2036	N		
1004-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621401.239	2632928.065	32.7079180	-108.1264670	200	140	N		
1005-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621400.671	2632778.452	32.7079150	-108.1269530	83	58	N		
1006-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621550.711	2632777.914	32.7083280	-108.1269560	685	480	N		
1007-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621550.986	2632928.048	32.7083290	-108.1264680	743	520	N		
1008-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621551.627	2633078.061	32.7083320	-108.1259800	883	618	N		
1009-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621401.516	2633078.292	32.7079200	-108.1259780	1796	1257	N		
1010-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621401.902	2633228.551	32.7079220	-108.1254900	947	663	N		
1011-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621502.707	2633218.340	32.7081990	-108.1255240	1942	1359	N		
1012-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621250.705	2632778.683	32.7075030	-108.1269510	1467	1027	N		
1013-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621250.102	2632628.854	32.7075000	-108.1274380	697	488	N		
1014-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621249.937	2632478.688	32.7074990	-108.1279260	1834	1284	N		
1015-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621249.553	2632328.705	32.7074960	-108.1284140	116	81	N		
1016-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621249.134	2632178.692	32.7074940	-108.1289020	116	81	N		
1017-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621248.716	2632028.710	32.7074920	-108.1293890	142	99	N		
1018-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621248.517	2631878.728	32.7074900	-108.1298770	163	114	N		
1019-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621247.954	2631728.715	32.7074870	-108.1303640	598	419	N		
1020-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621247.427	2631579.347	32.7074850	-108.1308500	1200	840	N		
1022-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621400.322	2632628.655	32.7079130	-108.1274400	134	94	N		
1023-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621399.939	2632478.305	32.7079110	-108.1279290	97	68	N		
1024-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621399.520	2632328.292	32.7079090	-108.1284170	240	168	N		
1025-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621549.522	2632327.910	32.7083210	-108.1284190	867	607	N		
1026-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621549.942	2632477.922	32.7083230	-108.1279320	346	242	N		
1027-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621550.326	2632627.903	32.7083250	-108.1274440	824	577	N		
1028-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621549.139	2632178.268	32.7083190	-108.1289060	674	472	N		
1029-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621548.648	2632027.948	32.7083160	-108.1293940	536	375	N		
1030-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621548.340	2631877.906	32.7083140	-108.1298820	1278	895	N		
1031-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621547.960	2631727.925	32.7083120	-108.1303700	624	437	N		
1032-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621547.507	2631577.975	32.7083100	-108.1308570	1616	1131	N		
1033-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621547.091	2631427.963	32.7083070	-108.1313450	829	580	N		
1034-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621397.161	2631428.341	32.7078950	-108.1313420	1029	720	N		
1035-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621397.613	2631578.415	32.7078980	-108.1308540	335	235	N		
1036-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621397.957	2631728.304	32.7079000	-108.1303670	203	142	N		
1037-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621398.447	2631878.194	32.7079020	-108.1298800	94	66	N		
1038-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621398.646	2632028.329	32.7079040	-108.1293920	119	83	N		
1039-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621399.100	2632178.372	32.7079060	-108.1289040	756	529	N		
1040-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621247.013	2631428.965	32.7074820	-108.1313390	574	402	N		
1041-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621102.176	2633379.060	32.7070990	-108.1249980	1551	1086	N		
1042-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621101.897	2633229.077	32.7070970	-108.1254850	2438	1707	N		
1043-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621101.401	2633079.064	32.7070950	-108.1259730	927	649	N		
1044-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621101.052	2632928.896	32.7070930	-108.1264610	3933	2753	N		
1045-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621100.703	2632779.036	32.7070910	-108.1269480	2580	1806	N		
1046-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621100.319	2632628.838	32.7070880	-108.1274370	2074	1452	N		

Footnotes:
[1]PreFS RAC for copper for small ground feeding bird applies to 0-6" soil sieved to < 2 mm (2000 µm). Pre-FS RAC for human health applies to 0-1" soil sieved to < 0.25 mm (250 µm). The ratio used to convert copper concentration of 0-1" sieved at <0.25 mm soils to 0-6" sieved at < 2 mm soils is from Appendix A (median ratio of SS samples) of Arcadis (2011). Multiplied copper concentration by 0.7 if outside windblown tailings (and by 1.5 if inside windblown tailings). If unsieved, multiplied by 0.9 if outside windblown tailings and by 1.3 if inside windblown tailings. The 0.9 and 1.3 are from median ratios of unsieved 0-1" soil in 2009 lab reports (at 25 m on transect) compared to sieved 0-6" co-located soil in Drexler lab report in Appendix D of the pH Monitoring Report (Appendix B to the FS Report) for soils in and outside of windblown tailings, respectively (FID 8, 18, 20 in tailings). A subset of the data collected using x-ray fluorescence as part of the Railroad Interim Removal Action (Golder 2013) was collected at 0-2 inch" and sieved at <0.25 mm; the same ratios described here were applied to these data to estimate 0 to 6 inch bgs.
[2]Data were collected for ecological endpoint and were not corrected to human health values.
[3]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as IRA.
[4]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as HWY 180.
[5]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as 2:1 slope.
[6]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as Volcanic Rock.
[7]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as NMDOT.
[8]If two samples were collected from the same location in the same sampling year (with identical sample location coordinates), an average was used in place of the two parent samples. For the co-located samples U04-1121 (SRK 2008) and FID 18 (Arcadis 2009), samples were collected in different years, and the sample from the more recent year was used (FID 18).
*Removed samples with the asterisk are set to 327 for the Theissens analysis. All other removed samples are completely voided.
-- means no data available at the location.

TABLE 3-2
STSIU Surface Soil Copper Results Adjusted to 0-6"

STSIU Feasibility Study
Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Location ID	Alternate ID	Source Report	Year Collected	Original Soil depth	Sieving Status	1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]	Northing (State Plane)	Easting (State Plane)	Latitude	Longitude	Copper Concentration[1] To Compare to HH Pre-FS RAC (250 µm sieve)	Copper Concentration[1] For Bird Pre-FS RAC Analysis (2000 µm sieve)	Pre-Interim Remedial Action (IRA) Dataset	Removed in Post-IRA Dataset	Reason Removed (also see this column's footnotes)
1047-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621099.935	2632478.794	32.7070860	-108.1279250	2294	1606	N		
1048-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621099.479	2632328.842	32.7070840	-108.1284120	2756	1929	N		
1049-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621099.060	2632178.828	32.7070820	-108.1289000	1354	948	N		
1050-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621098.787	2632028.722	32.7070800	-108.1293880	2443	1710	N		
1051-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621098.260	2631878.739	32.7070770	-108.1298750	2075	1453	N		
1052-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621097.952	2631728.756	32.7070750	-108.1303630	2530	1771	N		
1053-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621097.500	2631578.588	32.7070730	-108.1308510	2788	1952	N		
1054-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621097.085	2631428.513	32.7070700	-108.1313390	2767	1937	N		
1055-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620952.173	2633379.570	32.7066870	-108.1249950	673	471	N		
1056-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620951.713	2633229.371	32.7066850	-108.1254830	2895	2027	N		
1057-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620802.207	2633379.988	32.7062750	-108.1249920	4155	2909	N		
1058-SG-A		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620652.095	2633380.252	32.7058620	-108.1249900	4657	3260	N		
1058-SG-B		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621062.242	2631580.304	32.7069760	-108.1308450	2870	2009	N		
1059-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621060.693	2631730.528	32.7069730	-108.1303570	3033	2123	N		
1060-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621058.855	2631880.290	32.7069690	-108.1298700	2359	1651	N		
1061-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621055.165	2632028.754	32.7069600	-108.1293870	2047	1433	N		
1062-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621056.053	2632179.907	32.7069630	-108.1288960	2805	1964	N		
1063-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621050.328	2632328.551	32.7069490	-108.1284130	5025	3518	N		
1064-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621050.814	2632480.872	32.7069510	-108.1279170	2367	1657	N		
1065-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621054.039	2632629.694	32.7069610	-108.1274340	4446	3112	N		
1066-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621052.608	2632778.380	32.7069580	-108.1269500	113	79	N		
1067-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621047.609	2632928.533	32.7069460	-108.1264620	2268	1588	N		
1068-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620929.425	2633079.050	32.7066220	-108.1259720	4100	2870	N		
1069-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620802.114	2633228.744	32.7062730	-108.1254840	4077	2854	N		
1070-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620596.329	2633377.607	32.7057090	-108.1249980	1461	1023	N		
1071-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620377.736	2633527.729	32.7051090	-108.1245080	4489	3142	N		
1072-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621242.799	2631129.483	32.7074690	-108.1323130	2237	1566	N		
1073-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621246.937	2631003.874	32.7074790	-108.1327210	2746	1922	N		
1074-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621396.580	2630975.968	32.7078900	-108.1328130	4793	3355	N		
2000-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622002.316	2633225.837	32.7095720	-108.1255040	3531	2472	N	Removed	Co-located samples[8]
2001-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622001.783	2633075.828	32.7095700	-108.1259920	1176	823	N	Removed	Co-located samples[8]
2001-WG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621243.804	2629929.051	32.7074620	-108.1362150	367	257	N		
2002-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621851.524	2633077.104	32.7091570	-108.1259860	2549	1784	N		
2002-WG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621093.330	2629928.959	32.7070480	-108.1362140	636	445	N		
2003-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621851.910	2633227.115	32.7091590	-108.1254990	1110	777	N		
2003-WG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620943.145	2629929.453	32.7066360	-108.1362110	2751	1926	N		
2004-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621701.908	2633227.501	32.7087470	-108.1254960	802	561	N		
2004-WG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620793.105	2629930.132	32.7062230	-108.1362080	995	697	N		
2005-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621701.521	2633077.521	32.7087440	-108.1259840	2197	1538	N		
2005-WG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620343.315	2629931.247	32.7049870	-108.1362000	1912	1338	N		
2006-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621701.099	2632927.510	32.7087420	-108.1264710	1300	910	N		
2006-WG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620190.875	2629931.580	32.7045680	-108.1361970	1009	706	N		
2007-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621700.713	2632777.499	32.7087400	-108.1269590	1769	1238	N		
2007-WG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620043.310	2629932.051	32.7041620	-108.1361940	1746	1222	N		
2008-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621700.329	2632627.519	32.7087380	-108.1274470	719	503	N		
2008-WG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619893.490	2629932.146	32.7037500	-108.1361930	2716	1901	N		
2009-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621699.945	2632477.508	32.7087360	-108.1279340	478	335	N		

Footnotes:
[1]PreFS RAC for copper for small ground feeding bird applies to 0-6" soil sieved to < 2 mm (2000 µm). Pre-FS RAC for human health applies to 0-1" soil sieved to < 0.25 mm (250 µm). The ratio used to convert copper concentration of 0-1" sieved at <0.25 mm soils to 0-6" sieved at < 2 mm soils is from Appendix A (median ratio of SS samples) of Arcadis (2011). Multiplied copper concentration by 0.7 if outside windblown tailings (and by 1.5 if inside windblown tailings). If unsieved, multiplied by 0.9 if outside windblown tailings and by 1.3 if inside windblown tailings. The 0.9 and 1.3 are from median ratios of unsieved 0-1" soil in 2009 lab reports (at 25 m on transect) compared to sieved 0-6" co-located soil in Drexler lab report in Appendix D of the pH Monitoring Report (Appendix B to the FS Report) for soils in and outside of windblown tailings, respectively (FID 8, 18, 20 in tailings). A subset of the data collected using x-ray fluorescence as part of the Railroad Interim Removal Action (Golder 2013) was collected at 0-2 inch" and sieved at <0.25 mm; the same ratios described here were applied to these data to estimate 0 to 6 inch bgs.
[2]Data were collected for ecological endpoint and were not corrected to human health values.
[3]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as IRA.
[4]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as HWY 180.
[5]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as 2:1 slope.
[6]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as Volcanic Rock.
[7]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as NMDOT.
[8]If two samples were collected from the same location in the same sampling year (with identical sample location coordinates), an average was used in place of the two parent samples. For the co-located samples U04-1121 (SRK 2008) and FID 18 (Arcadis 2009), samples were collected in different years, and the sample from the more recent year was used (FID 18).
*Removed samples with the asterisk are set to 327 for the Theissens analysis. All other removed samples are completely voided.
-- means no data available at the location.

TABLE 3-2
STSIU Surface Soil Copper Results Adjusted to 0-6"

STSIU Feasibility Study
Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Location ID	Alternate ID	Source Report	Year Collected	Original Soil depth	Sieving Status	1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]	Northing (State Plane)	Easting (State Plane)	Latitude	Longitude	Copper Concentration[1]: To Compare to HH Pre-FS RAC (250 µm sieve)	Copper Concentration[1]: For Bird Pre-FS RAC Analysis (2000 µm sieve)	Pre-Interim Remedial Action (IRA) Dataset	Removed in Post-IRA Dataset	Reason Removed (also see this column's footnotes)
2009-WG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619743.268	2629932.701	32.7033380	-108.1361900	1920	1344	N		
2010-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621699.525	2632327.528	32.7087330	-108.1284220	490	343	N		
2010-WG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619593.302	2629933.073	32.7029250	-108.1361870	2475	1733	N		
2011-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621699.142	2632177.517	32.7087310	-108.1289100	189	132	N		
2011-WG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619443.154	2629933.597	32.7025130	-108.1361840	2880	2016	N		
2012-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621698.760	2632027.506	32.7087290	-108.1293970	107	75	N		
2012-WG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619293.333	2629933.877	32.7021010	-108.1361820	1653	1157	N		
2013-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621698.343	2631877.526	32.7087260	-108.1298850	261	183	N		
2013-WG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619159.376	2629933.864	32.7017330	-108.1361800	2355	1649	N		
2014-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621698.108	2631727.515	32.7087250	-108.1303720	372	260	N		
2014-WG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		618993.628	2630084.643	32.7012780	-108.1356890	273	191	N		
2015-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621697.546	2631577.504	32.7087220	-108.1308600	979	685	N		
2015-WG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619143.812	2630084.241	32.7016910	-108.1356910	512	358	N		
2016-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621697.167	2631427.523	32.7087200	-108.1313480	1936	1355	N		
2016-WG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619293.633	2630083.837	32.7021030	-108.1356940	864	605	N		
2017-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621696.788	2631277.512	32.7087180	-108.1318350	2643	1850	N		
2017-WG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619443.636	2630083.435	32.7025150	-108.1356970	152	106	N		
2018-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621846.755	2631277.135	32.7091300	-108.1318380	1546	1082	N		
2018-WG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619292.998	2629783.917	32.7020990	-108.1366690	2608	1826	N		
2019-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621847.170	2631427.115	32.7091320	-108.1313500	492	344	N		
2019-WG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619292.263	2629633.955	32.7020960	-108.1371570	1462	1023	N		
2020-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621850.679	2632777.145	32.7091520	-108.1269610	1901	1331	N		
2020-WG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619442.364	2629637.184	32.7025080	-108.1371470	395	277	N		
2021-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621850.992	2632927.094	32.7091540	-108.1264740	975	683	N		
2021-WG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619442.782	2629783.453	32.7025110	-108.1366720	1021	715	N		
2022-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622000.377	2632926.338	32.7095650	-108.1264780	1444	1011	N	Removed	Co-located samples[8]
2022-WG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619593.040	2629783.052	32.7029230	-108.1366750	2117	1482	N		
2023-WG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619592.787	2629642.598	32.7029220	-108.1371310	342	239	N		
2024-WG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619742.380	2629632.753	32.7033330	-108.1371650	260	182	N		
2025-WG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619742.896	2629782.896	32.7033350	-108.1366760	1144	801	N		
2026-WG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619892.718	2629782.125	32.7037470	-108.1366800	923	646	N		
2027-WG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620042.866	2629781.940	32.7041600	-108.1366820	390	273	N		
29123_2013		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		618493.469	2630424.087	32.6999060	-108.1345800	985	690	N		
5003-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		623050.964	2633073.556	32.7124540	-108.1260080	2243	1570	N		
5004-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		623053.134	2633223.474	32.7124610	-108.1255210	1569	1098	N		
5005-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		623052.283	2633373.721	32.7124590	-108.1250330	1385	970	N		
5006-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		623052.635	2633523.849	32.7124620	-108.1245440	1418	993	N		
5007-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		623052.914	2633674.099	32.7124630	-108.1240560	994	696	N		
5008-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		623053.341	2633823.704	32.7124660	-108.1235700	103	72	N		
5009-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622901.447	2632924.400	32.7120410	-108.1264920	2560	1792	N		
5010-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622901.504	2633075.235	32.7120430	-108.1260020	2262	1583	N		
5011-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622901.528	2633224.624	32.7120440	-108.1255160	1359	951	N		
5012-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622902.280	2633374.446	32.7120470	-108.1250290	2167	1517	N		
5013-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622902.559	2633524.267	32.7120490	-108.1245420	811	568	N		
5014-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622902.910	2633674.764	32.7120510	-108.1240530	631	442	N		
5015-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622903.774	2633824.217	32.7120550	-108.1235670	1844	1291	N		
5016-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622750.348	2632624.711	32.7116240	-108.1274650	2432	1702	N		

Footnotes:
[1]PreFS RAC for copper for small ground feeding bird applies to 0-6" soil sieved to < 2 mm (2000 µm). Pre-FS RAC for human health applies to 0-1" soil sieved to < 0.25 mm (250 µm). The ratio used to convert copper concentration of 0-1" sieved at <0.25 mm soils to 0-6" sieved at < 2 mm soils is from Appendix A (median ratio of SS samples) of Arcadis (2011). Multiplied copper concentration by 0.7 if outside windblown tailings (and by 1.5 if inside windblown tailings). If unsieved, multiplied by 0.9 if outside windblown tailings and by 1.3 if inside windblown tailings. The 0.9 and 1.3 are from median ratios of unsieved 0-1" soil in 2009 lab reports (at 25 m on transect) compared to sieved 0-6" co-located soil in Drexler lab report in Appendix D of the pH Monitoring Report (Appendix B to the FS Report) for soils in and outside of windblown tailings, respectively (FID 8, 18, 20 in tailings). A subset of the data collected using x-ray fluorescence as part of the Railroad Interim Removal Action (Golder 2013) was collected at 0-2 inch" and sieved at <0.25 mm; the same ratios described here were applied to these data to estimate 0 to 6 inch bgs.
[2]Data were collected for ecological endpoint and were not corrected to human health values.
[3]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as IRA.
[4]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as HWY 180.
[5]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as 2:1 slope.
[6]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as Volcanic Rock.
[7]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as NMDOT.
[8]If two samples were collected from the same location in the same sampling year (with identical sample location coordinates), an average was used in place of the two parent samples. For the co-located samples U04-1121 (SRK 2008) and FID 18 (Arcadis 2009), samples were collected in different years, and the sample from the more recent year was used (FID 18).
*Removed samples with the asterisk are set to 327 for the Theissens analysis. All other removed samples are completely voided.
-- means no data available at the location.

TABLE 3-2
STSIU Surface Soil Copper Results Adjusted to 0-6"

STSIU Feasibility Study
Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Location ID	Alternate ID	Source Report	Year Collected	Original Soil depth	Sieving Status	1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]	Northing (State Plane)	Easting (State Plane)	Latitude	Longitude	Copper Concentration[1] To Compare to HH Pre-FS RAC (250 µm sieve)	Copper Concentration[1] For Bird Pre-FS RAC Analysis (2000 µm sieve)	Pre-Interim Remedial Action (IRA) Dataset	Removed in Post-IRA Dataset	Reason Removed (also see this column's footnotes)
5017-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622750.732	2632774.840	32.7116260	-108.1269770	959	671	N		
5018-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622750.935	2632924.876	32.7116280	-108.1264890	2291	1604	N		
5019-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622751.321	2633074.882	32.7116300	-108.1260020	1023	716	N		
5020-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622751.492	2633224.119	32.7116320	-108.1255160	856	599	N		
5021-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622752.387	2633374.711	32.7116350	-108.1250270	2638	1847	N		
5022-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622752.811	2633524.655	32.7116370	-108.1245390	2341	1639	N		
5023-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622753.127	2633674.569	32.7116390	-108.1240520	1908	1336	N		
5024-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622753.298	2633824.728	32.7116410	-108.1235640	2211	1548	N		
5025-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622597.905	2631725.361	32.7111980	-108.1303880	2061	1443	N		
5026-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622577.986	2631875.065	32.7111440	-108.1299010	600	420	N		
5027-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622598.741	2632025.036	32.7112020	-108.1294130	447	313	N		
5028-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622599.159	2632175.074	32.7112050	-108.1289260	2285	1600	N		
5029-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622599.505	2632324.927	32.7112070	-108.1284380	2416	1691	N		
5030-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622599.815	2632475.272	32.7112090	-108.1279500	401	281	N		
5031-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622600.272	2632625.217	32.7112110	-108.1274620	1066	746	N		
5032-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622600.693	2632775.039	32.7112140	-108.1269750	2022	1415	N		
5033-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622601.150	2632925.385	32.7112160	-108.1264860	2158	1511	N		
5034-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622601.248	2633087.478	32.7112170	-108.1259590	1686	1180	N		
5035-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622600.831	2633225.672	32.7112170	-108.1255100	731	512	N		
5036-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622602.238	2633375.312	32.7112220	-108.1250230	1447	1013	N		
5037-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622602.699	2633525.258	32.7112250	-108.1245360	730	511	N		
5038-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622603.051	2633675.172	32.7112270	-108.1240490	275	193	N		
5039-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622603.623	2633825.118	32.7112300	-108.1235610	738	517	N		
5040-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622447.867	2631725.617	32.7107860	-108.1303860	638	447	N		
5041-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622448.357	2631875.533	32.7107880	-108.1298980	690	483	N		
5042-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622448.956	2632025.633	32.7107910	-108.1294100	2356	1649	N		
5043-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622449.082	2632175.886	32.7107920	-108.1289220	1068	748	N		
5044-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622449.756	2632325.648	32.7107950	-108.1284350	1018	713	N		
5045-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622449.994	2632475.655	32.7107970	-108.1279470	996	697	N		
5046-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622450.051	2632625.662	32.7107980	-108.1274590	270	189	N		
5047-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622450.581	2632775.393	32.7108010	-108.1269720	1286	900	N		
5048-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622451.185	2632925.493	32.7108040	-108.1264850	334	234	N		
5049-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622450.810	2633074.176	32.7108040	-108.1260010	809	566	N		
5050-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622452.696	2633234.676	32.7108100	-108.1254790	841	589	N		
5051-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622452.199	2633375.576	32.7108100	-108.1250210	706	494	N		
5052-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622452.733	2633525.430	32.7108130	-108.1245340	243	170	N		
5053-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622453.268	2633675.377	32.7108150	-108.1240470	401	281	N		
5054-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622453.511	2633825.568	32.7108170	-108.1235580	2501	1751	N		
5055-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622296.385	2631125.933	32.7103640	-108.1323340	706	494	N		
5056-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622296.763	2631275.941	32.7103670	-108.1318460	565	396	N		
5057-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622297.178	2631425.950	32.7103690	-108.1313580	836	585	N		
5058-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622297.484	2631575.958	32.7103710	-108.1308710	1392	974	N		
5059-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622298.083	2631725.720	32.7103740	-108.1303840	408	286	N		
5060-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622298.390	2631875.913	32.7103760	-108.1298960	2605	1824	N		
5061-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622298.772	2632025.798	32.7103780	-108.1294080	1058	741	N		
5062-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622299.117	2632175.714	32.7103800	-108.1289210	704	493	N		
5063-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622299.463	2632325.814	32.7103820	-108.1284330	2175	1523	N		

Footnotes:
[1]PreFS RAC for copper for small ground feeding bird applies to 0-6" soil sieved to < 2 mm (2000 µm). Pre-FS RAC for human health applies to 0-1" soil sieved to < 0.25 mm (250 µm). The ratio used to convert copper concentration of 0-1" sieved at <0.25 mm soils to 0-6" sieved at < 2 mm soils is from Appendix A (median ratio of SS samples) of Arcadis (2011). Multiplied copper concentration by 0.7 if outside windblown tailings (and by 1.5 if inside windblown tailings). If unsieved, multiplied by 0.9 if outside windblown tailings and by 1.3 if inside windblown tailings. The 0.9 and 1.3 are from median ratios of unsieved 0-1" soil in 2009 lab reports (at 25 m on transect) compared to sieved 0-6" co-located soil in Drexler lab report in Appendix D of the pH Monitoring Report (Appendix B to the FS Report) for soils in and outside of windblown tailings, respectively (FID 8, 18, 20 in tailings). A subset of the data collected using x-ray fluorescence as part of the Railroad Interim Removal Action (Golder 2013) was collected at 0-2 inch" and sieved at <0.25 mm; the same ratios described here were applied to these data to estimate 0 to 6 inch bgs.
[2]Data were collected for ecological endpoint and were not corrected to human health values.
[3]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as IRA.
[4]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as HWY 180.
[5]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as 2:1 slope.
[6]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as Volcanic Rock.
[7]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as NMDOT.
[8]If two samples were collected from the same location in the same sampling year (with identical sample location coordinates), an average was used in place of the two parent samples. For the co-located samples U04-1121 (SRK 2008) and FID 18 (Arcadis 2009), samples were collected in different years, and the sample from the more recent year was used (FID 18).
*Removed samples with the asterisk are set to 327 for the Theissens analysis. All other removed samples are completely voided.
-- means no data available at the location.

TABLE 3-2
STSIU Surface Soil Copper Results Adjusted to 0-6"

STSIU Feasibility Study
Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Location ID	Alternate ID	Source Report	Year Collected	Original Soil depth	Sieving Status	1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]	Northing (State Plane)	Easting (State Plane)	Latitude	Longitude	Copper Concentration[1] To Compare to HH Pre-FS RAC (250 µm sieve)	Copper Concentration[1] For Bird Pre-FS RAC Analysis (2000 µm sieve)	Pre-Interim Remedial Action (IRA) Dataset	Removed in Post-IRA Dataset	Reason Removed (also see this column's footnotes)
5064-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622299.919	2632475.946	32.7103850	-108.1279450	475	333	N		
5065-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622300.267	2632625.892	32.7103870	-108.1274570	141	99	N		
5066-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622300.688	2632775.870	32.7103890	-108.1269700	2047	1433	N		
5067-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622301.109	2632926.032	32.7103910	-108.1264810	1914	1340	N		
5068-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622302.514	2633076.073	32.7103960	-108.1259940	261	183	N		
5069-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622301.521	2633225.062	32.7103950	-108.1255090	1145	802	N		
5070-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622302.379	2633375.902	32.7103980	-108.1250190	1256	879	N		
5071-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622303.386	2633525.574	32.7104020	-108.1245320	1332	932	N		
5072-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622303.118	2633676.103	32.7104030	-108.1240430	1527	1069	N		
5073-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622303.689	2633826.265	32.7104050	-108.1235550	336	235	N		
5074-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622304.047	2633974.981	32.7104070	-108.1230710	777	544	N		
5076-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622146.383	2631126.340	32.7099520	-108.1323310	1185	830	N		
5077-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622146.760	2631276.319	32.7099540	-108.1318440	175	123	N		
5078-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622146.048	2631426.109	32.7099540	-108.1313560	1700	1190	N		
5079-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622147.554	2631576.337	32.7099590	-108.1308680	916	641	N		
5080-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622147.133	2631726.497	32.7099590	-108.1303800	821	575	N		
5081-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622148.825	2631876.110	32.7099650	-108.1298930	170	119	N		
5082-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622150.113	2632027.044	32.7099690	-108.1294030	534	374	N		
5083-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622149.770	2632176.097	32.7099700	-108.1289180	330	231	N		
5084-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622149.060	2632326.411	32.7099690	-108.1284290	145	102	N		
5085-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622149.444	2632476.081	32.7099710	-108.1279430	722	505	N		
5086-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622151.612	2632625.541	32.7099780	-108.1274570	125	88	N		
5087-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622150.173	2632777.114	32.7099750	-108.1269640	845	592	N		
5088-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622152.819	2632925.375	32.7099840	-108.1264820	222	155	N		
5089-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622152.620	2633076.459	32.7099840	-108.1259910	432	302	N		
5090-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622152.063	2633225.727	32.7099840	-108.1255060	1034	724	N		
5091-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622152.230	2633376.443	32.7099860	-108.1250160	918	643	N		
5092-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622157.457	2633526.434	32.7100010	-108.1245280	1055	739	N		
5093-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622153.371	2633676.154	32.7099910	-108.1240410	1454	1018	N		
5094-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622153.470	2633826.162	32.7099920	-108.1235540	230	161	N		
5095-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622154.296	2633976.233	32.7099960	-108.1230660	143	100	N		
5096-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622154.214	2634126.394	32.7099970	-108.1225780	2005	1404	N		
5098-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621995.966	2630976.738	32.7095380	-108.1328160	75	53	N		
5099-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621996.380	2631126.717	32.7095400	-108.1323280	1101	771	N		
5100-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621996.758	2631276.727	32.7095420	-108.1318410	2548	1784	N		
5101-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621997.172	2631426.736	32.7095440	-108.1313530	2702	1891	N		
5102-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621997.335	2631576.223	32.7095460	-108.1308670	1976	1383	N		
5103-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621998.402	2631727.587	32.7095500	-108.1303750	95	67	N		
5104-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621997.877	2631876.057	32.7095500	-108.1298920	2482	1737	N		
5105-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621997.893	2632026.434	32.7095510	-108.1294030	2844	1991	N		
5106-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621998.275	2632176.690	32.7095530	-108.1289150	1931	1352	N		
5107-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621999.097	2632325.409	32.7095570	-108.1284310	2981	2087	N		
5108-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621999.114	2632476.371	32.7095580	-108.1279410	2676	1873	N		
5109-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622000.082	2632625.798	32.7095620	-108.1274550	1563	1094	N		
5110-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621997.883	2632775.923	32.7095570	-108.1269670	89	62	N		
5111-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622000.377	2632926.338	32.7095650	-108.1264780	308	216	N	Removed	Co-located samples[8]
5112-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622001.783	2633075.828	32.7095700	-108.1259920	925	648	N	Removed	Co-located samples[8]

Footnotes:
[1]PreFS RAC for copper for small ground feeding bird applies to 0-6" soil sieved to < 2 mm (2000 µm). Pre-FS RAC for human health applies to 0-1" soil sieved to < 0.25 mm (250 µm). The ratio used to convert copper concentration of 0-1" sieved at <0.25 mm soils to 0-6" sieved at < 2 mm soils is from Appendix A (median ratio of SS samples) of Arcadis (2011). Multiplied copper concentration by 0.7 if outside windblown tailings (and by 1.5 if inside windblown tailings). If unsieved, multiplied by 0.9 if outside windblown tailings and by 1.3 if inside windblown tailings. The 0.9 and 1.3 are from median ratios of unsieved 0-1" soil in 2009 lab reports (at 25 m on transect) compared to sieved 0-6" co-located soil in Drexler lab report in Appendix D of the pH Monitoring Report (Appendix B to the FS Report) for soils in and outside of windblown tailings, respectively (FID 8, 18, 20 in tailings). A subset of the data collected using x-ray fluorescence as part of the Railroad Interim Removal Action (Golder 2013) was collected at 0-2 inch" and sieved at <0.25 mm; the same ratios described here were applied to these data to estimate 0 to 6 inch bgs.
[2]Data were collected for ecological endpoint and were not corrected to human health values.
[3]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as IRA.
[4]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as HWY 180.
[5]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as 2:1 slope.
[6]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as Volcanic Rock.
[7]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as NMDOT.
[8]If two samples were collected from the same location in the same sampling year (with identical sample location coordinates), an average was used in place of the two parent samples. For the co-located samples U04-1121 (SRK 2008) and FID 18 (Arcadis 2009), samples were collected in different years, and the sample from the more recent year was used (FID 18).
*Removed samples with the asterisk are set to 327 for the Theissens analysis. All other removed samples are completely voided.
-- means no data available at the location.

TABLE 3-2
STSIU Surface Soil Copper Results Adjusted to 0-6"

STSIU Feasibility Study
Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Location ID	Alternate ID	Source Report	Year Collected	Original Soil depth	Sieving Status	1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]	Northing (State Plane)	Easting (State Plane)	Latitude	Longitude	Copper Concentration[1] To Compare to HH Pre-FS RAC (250 µm sieve)	Copper Concentration[1] For Bird Pre-FS RAC Analysis (2000 µm sieve)	Pre-Interim Remedial Action (IRA) Dataset	Removed in Post-IRA Dataset	Reason Removed (also see this column's footnotes)
5113-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622002.316	2633225.837	32.7095720	-108.1255040	2387	1671	N	Removed	Co-located samples[8]
5114-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622002.300	2633376.707	32.7095730	-108.1250130	541	379	N		
5115-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622002.689	2633526.716	32.7095760	-108.1245260	2194	1536	N		
5116-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622003.077	2633676.726	32.7095780	-108.1240380	149	104	N		
5117-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622003.503	2633826.735	32.7095800	-108.1235500	1290	903	N		
5118-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622003.893	2633976.714	32.7095820	-108.1230630	1059	741	N		
5119-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622004.356	2634126.878	32.7095850	-108.1225750	134	94	N		
5120-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622004.419	2634277.594	32.7095860	-108.1220850	313	219	N		
5122-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621845.964	2630977.114	32.7091250	-108.1328130	241	169	N		
5123-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621846.377	2631127.125	32.7091280	-108.1323260	919	643	N		
5126-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621847.113	2631576.939	32.7091330	-108.1308630	654	458	N		
5127-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621846.838	2631726.701	32.7091340	-108.1303760	109	76	N		
5128-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621848.346	2631877.115	32.7091390	-108.1298870	813	569	N		
5129-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621847.856	2632026.354	32.7091390	-108.1294020	952	666	N		
5130-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621849.145	2632177.105	32.7091430	-108.1289120	86	60	N		
5131-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621849.419	2632326.991	32.7091450	-108.1284250	176	123	N		
5132-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621849.874	2632477.156	32.7091480	-108.1279370	637	446	N		
5133-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621850.295	2632627.197	32.7091500	-108.1274490	103	72	N		
5138-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621852.298	2633377.125	32.7091610	-108.1250110	345	242	N		
5139-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621852.686	2633527.104	32.7091630	-108.1245230	724	507	N		
5140-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621853.075	2633677.114	32.7091650	-108.1240360	539	377	N		
5141-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621853.501	2633827.125	32.7091680	-108.1235480	1303	912	N		
5142-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621853.891	2633977.104	32.7091700	-108.1230600	1691	1184	N		
5143-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621854.282	2634127.114	32.7091720	-108.1225730	326	228	N		
5144-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621854.673	2634277.124	32.7091740	-108.1220850	357	250	N		
5145-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621855.174	2634427.319	32.7091770	-108.1215960	1512	1058	N		
5146-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621855.458	2634577.114	32.7091790	-108.1211100	469	328	N		
5148-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621695.997	2630977.521	32.7087130	-108.1328110	1888	1322	N		
5149-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621696.374	2631127.532	32.7087150	-108.1323230	1068	748	N		
5164-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621702.295	2633377.512	32.7087490	-108.1250080	1025	718	N		
5165-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621702.683	2633527.523	32.7087510	-108.1245210	666	466	N		
5166-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621703.072	2633677.503	32.7087530	-108.1240330	323	226	N		
5167-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621703.498	2633827.514	32.7087560	-108.1235450	738	517	N		
5168-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621703.888	2633977.494	32.7087580	-108.1230580	283	198	N		
5169-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621704.279	2634127.505	32.7087600	-108.1225700	163	114	N		
5170-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621704.671	2634277.515	32.7087620	-108.1220820	1511	1058	N		
5171-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621705.063	2634427.495	32.7087640	-108.1215950	865	606	N		
5172-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621705.456	2634577.506	32.7087670	-108.1211070	2160	1512	N		
5173-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621545.994	2630977.928	32.7083010	-108.1328080	2746	1922	N		
5174-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621546.372	2631127.909	32.7083030	-108.1323210	4793	3355	N		
5175-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621546.786	2631277.921	32.7083050	-108.1318330	1603	1122	N		
5189-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621552.293	2633377.899	32.7083370	-108.1250060	691	484	N		
5190-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621552.681	2633527.911	32.7083390	-108.1245180	1277	894	N		
5191-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621553.106	2633677.891	32.7083410	-108.1240300	939	657	N		
5192-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621553.495	2633827.903	32.7083430	-108.1235430	230	161	N		
5193-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621553.885	2633977.914	32.7083450	-108.1230550	92	64	N		
5194-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621554.276	2634127.895	32.7083480	-108.1225670	448	314	N		

Footnotes:
[1]PreFS RAC for copper for small ground feeding bird applies to 0-6" soil sieved to < 2 mm (2000 µm). Pre-FS RAC for human health applies to 0-1" soil sieved to < 0.25 mm (250 µm). The ratio used to convert copper concentration of 0-1" sieved at <0.25 mm soils to 0-6" sieved at < 2 mm soils is from Appendix A (median ratio of SS samples) of Arcadis (2011). Multiplied copper concentration by 0.7 if outside windblown tailings (and by 1.5 if inside windblown tailings). If unsieved, multiplied by 0.9 if outside windblown tailings and by 1.3 if inside windblown tailings. The 0.9 and 1.3 are from median ratios of unsieved 0-1" soil in 2009 lab reports (at 25 m on transect) compared to sieved 0-6" co-located soil in Drexler lab report in Appendix D of the pH Monitoring Report (Appendix B to the FS Report) for soils in and outside of windblown tailings, respectively (FID 8, 18, 20 in tailings). A subset of the data collected using x-ray fluorescence as part of the Railroad Interim Removal Action (Golder 2013) was collected at 0-2 inch" and sieved at <0.25 mm; the same ratios described here were applied to these data to estimate 0 to 6 inch bgs.
[2]Data were collected for ecological endpoint and were not corrected to human health values.
[3]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as IRA.
[4]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as HWY 180.
[5]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as 2:1 slope.
[6]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as Volcanic Rock.
[7]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as NMDOT.
[8]If two samples were collected from the same location in the same sampling year (with identical sample location coordinates), an average was used in place of the two parent samples. For the co-located samples U04-1121 (SRK 2008) and FID 18 (Arcadis 2009), samples were collected in different years, and the sample from the more recent year was used (FID 18).
*Removed samples with the asterisk are set to 327 for the Theissens analysis. All other removed samples are completely voided.
-- means no data available at the location.

TABLE 3-2
STSIU Surface Soil Copper Results Adjusted to 0-6”

STSIU Feasibility Study
Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Location ID	Alternate ID	Source Report	Year Collected	Original Soil depth	Sieving Status	1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]	Northing (State Plane)	Easting (State Plane)	Latitude	Longitude	Copper Concentration[1] To Compare to HH Pre-FS RAC (250 µm sieve)	Copper Concentration[1] For Bird Pre-FS RAC Analysis (2000 µm sieve)	Pre-Interim Remedial Action (IRA) Dataset	Removed in Post-IRA Dataset	Reason Removed (also see this column's footnotes)
5195-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621554.668	2634277.907	32.7083500	-108.1220800	863	604	N		
5196-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621555.060	2634427.887	32.7083520	-108.1215920	1940	1358	N		
5197-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621555.453	2634577.899	32.7083540	-108.1211040	670	469	N		
5199-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621396.369	2631128.316	32.7078910	-108.1323180	1723	1206	N		
5200-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621396.783	2631278.298	32.7078930	-108.1318300	2574	1802	N		
5214-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621402.290	2633378.286	32.7079240	-108.1250030	1612	1128	N		
5215-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621402.678	2633528.298	32.7079260	-108.1245150	1667	1167	N		
5216-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621403.103	2633678.311	32.7079290	-108.1240280	754	528	N		
5217-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621403.493	2633828.292	32.7079310	-108.1235400	404	283	N		
5218-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621403.883	2633978.304	32.7079330	-108.1230520	395	277	N		
5219-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621404.274	2634128.286	32.7079350	-108.1225650	988	692	N		
5220-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621404.665	2634278.298	32.7079370	-108.1220770	1796	1257	N		
5221-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621405.058	2634428.310	32.7079400	-108.1215890	554	388	N		
5222-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621405.451	2634578.291	32.7079420	-108.1211020	1895	1327	N		
5228-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621246.780	2631278.706	32.7074810	-108.1318270	1018	713	N		
5242-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621252.712	2633528.686	32.7075140	-108.1245130	226	158	N		
5243-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621253.101	2633678.699	32.7075160	-108.1240250	104	73	N		
5244-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621253.490	2633828.681	32.7075190	-108.1235370	155	109	N		
5245-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621253.880	2633978.694	32.7075210	-108.1230500	713	499	N		
5246-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621254.271	2634128.707	32.7075230	-108.1225620	881	617	N		
5247-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621254.663	2634278.689	32.7075250	-108.1220740	333	233	N		
5248-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621255.055	2634428.702	32.7075270	-108.1215870	763	534	N		
5249-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621255.448	2634578.684	32.7075300	-108.1210990	4358	3051	N	Removed*	Bedrock dust
5250-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621255.842	2634728.697	32.7075320	-108.1206110	21824	15277	N	Removed*	Bedrock dust
5251-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621256.236	2634878.679	32.7075340	-108.1201240	15604	10923	N	Removed*	Bedrock dust
5256-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621103.488	2633829.101	32.7071060	-108.1235350	1317	922	N		
5257-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621103.878	2633979.084	32.7071080	-108.1230470	2426	1698	N		
5258-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621104.269	2634129.098	32.7071110	-108.1225590	293	205	N		
5259-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621104.660	2634279.080	32.7071130	-108.1220720	484	339	N		
5260-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621105.053	2634429.094	32.7071150	-108.1215840	694	486	N		
5261-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621105.446	2634579.077	32.7071170	-108.1210960	1942	1359	N		
5262-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621105.839	2634729.090	32.7071190	-108.1206090	928	650	N		
5263-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621106.234	2634879.073	32.7071220	-108.1201210	980	686	N		
5268-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620953.485	2633829.490	32.7066940	-108.1235320	1652	1156	N		
5270-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620954.266	2634129.488	32.7066980	-108.1225570	1080	756	N		
5271-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620954.658	2634279.472	32.7067010	-108.1220690	739	517	N		
5272-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620955.050	2634429.486	32.7067030	-108.1215820	607	425	N		
5273-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620955.479	2634579.469	32.7067050	-108.1210940	1288	902	N		
5274-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620955.873	2634729.484	32.7067070	-108.1206060	1359	951	N		
5275-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620956.268	2634879.467	32.7067100	-108.1201190	2931	2052	N		
5276-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620956.663	2635029.481	32.7067120	-108.1196310	3997	2798	N	Removed*	Bedrock dust
5282-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620805.871	2634729.877	32.7062950	-108.1206040	1389	972	N		
5374-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621845.628	2630838.454	32.7091230	-108.1332640	1126	788	N		
5376-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622897.019	2632789.270	32.7120280	-108.1269310	1102	771	N		
5377-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		623053.106	2633949.501	32.7124660	-108.1231610	137	96	N		
5378-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622147.707	2634257.837	32.7099800	-108.1221500	398	279	N		
5379-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621994.033	2634404.136	32.7095580	-108.1216730	165	116	N		

Footnotes:
[1]PreFS RAC for copper for small ground feeding bird applies to 0-6" soil sieved to < 2 mm (2000 µm). Pre-FS RAC for human health applies to 0-1" soil sieved to < 0.25 mm (250 µm). The ratio used to convert copper concentration of 0-1" sieved at <0.25 mm soils to 0-6" sieved at < 2 mm soils is from Appendix A (median ratio of SS samples) of Arcadis (2011). Multiplied copper concentration by 0.7 if outside windblown tailings (and by 1.5 if inside windblown tailings). If unsieved, multiplied by 0.9 if outside windblown tailings and by 1.3 if inside windblown tailings. The 0.9 and 1.3 are from median ratios of unsieved 0-1" soil in 2009 lab reports (at 25 m on transect) compared to sieved 0-6" co-located soil in Drexler lab report in Appendix D of the pH Monitoring Report (Appendix B to the FS Report) for soils in and outside of windblown tailings, respectively (FID 8, 18, 20 in tailings). A subset of the data collected using x-ray fluorescence as part of the Railroad Interim Removal Action (Golder 2013) was collected at 0-2 inch" and sieved at <0.25 mm; the same ratios described here were applied to these data to estimate 0 to 6 inch bgs.
[2]Data were collected for ecological endpoint and were not corrected to human health values.
[3]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as IRA.
[4]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as HWY 180.
[5]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as 2:1 slope.
[6]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as Volcanic Rock.
[7]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as NMDOT.
[8]If two samples were collected from the same location in the same sampling year (with identical sample location coordinates), an average was used in place of the two parent samples. For the co-located samples U04-1121 (SRK 2008) and FID 18 (Arcadis 2009), samples were collected in different years, and the sample from the more recent year was used (FID 18).
*Removed samples with the asterisk are set to 327 for the Theissens analysis. All other removed samples are completely voided.
-- means no data available at the location.

TABLE 3-2
STSIU Surface Soil Copper Results Adjusted to 0-6"

STSIU Feasibility Study
Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Location ID	Alternate ID	Source Report	Year Collected	Original Soil depth	Sieving Status	1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]	Northing (State Plane)	Easting (State Plane)	Latitude	Longitude	Copper Concentration[1] To Compare to HH Pre-FS RAC (250 µm sieve)	Copper Concentration[1] For Bird Pre-FS RAC Analysis (2000 µm sieve)	Pre-Interim Remedial Action (IRA) Dataset	Removed in Post-IRA Dataset	Reason Removed (also see this column's footnotes)
5380-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621102.807	2635002.623	32.7071130	-108.1197200	1588	1112	N		
5381-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620828.941	2634876.047	32.7063590	-108.1201290	1060	742	N		
6001-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		623500.709	2632772.765	32.7136870	-108.1269910	1334	934	N		
6002-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		623350.707	2632773.180	32.7132750	-108.1269880	337	236	N		
6075-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		622144.395	2630376.326	32.7099410	-108.1347700	593	415	N		
6097-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621994.392	2630376.730	32.7095290	-108.1347670	84	59	N		
6121-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621844.389	2630377.134	32.7091160	-108.1347640	159	111	N		
6198-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621394.792	2630528.297	32.7078820	-108.1342690	1463	1024	N		
6225-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621244.789	2630528.702	32.7074690	-108.1342660	1377	964	N		
6226-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621244.415	2630378.720	32.7074670	-108.1347530	2000	1400	N		
6227-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621244.005	2630228.706	32.7074650	-108.1352410	2730	1911	N		
6253-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621094.002	2630229.110	32.7070530	-108.1352380	275	193	N		
6254-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621094.412	2630379.093	32.7070550	-108.1347510	820	574	N		
6255-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621094.786	2630529.107	32.7070570	-108.1342630	2152	1506	N		
6265-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620943.999	2630229.483	32.7066400	-108.1352360	128	90	N		
6266-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620944.409	2630379.497	32.7066430	-108.1347480	2609	1826	N		
6267-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620944.784	2630529.481	32.7066450	-108.1342600	1865	1306	N		
6278-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620793.996	2630229.886	32.7062280	-108.1352330	145	102	N		
6279-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620794.406	2630379.901	32.7062300	-108.1347450	926	648	N		
6280-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620794.817	2630529.886	32.7062330	-108.1342580	1720	1204	N		
6283-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620643.994	2630230.289	32.7058160	-108.1352300	132	92	N		
6284-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620644.404	2630380.275	32.7058180	-108.1347430	546	382	N		
6285-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620644.815	2630530.291	32.7058200	-108.1342550	2950	2065	N		
6287-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620494.027	2630230.693	32.7054040	-108.1352280	535	375	N		
6288-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620494.401	2630380.679	32.7054060	-108.1347400	1124	787	N		
6289-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620494.812	2630530.665	32.7054080	-108.1342530	145	102	N		
6293-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620344.398	2630381.083	32.7049930	-108.1347370	623	436	N		
6294-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620344.809	2630531.070	32.7049960	-108.1342500	116	81	N		
6298-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620194.396	2630381.456	32.7045810	-108.1347350	160	112	N		
6299-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620194.806	2630531.474	32.7045830	-108.1342470	156	109	N		
6305-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620044.393	2630381.861	32.7041690	-108.1347320	2215	1551	N		
6306-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620044.810	2639531.872	32.7042380	-108.1049860	198	139	N		
6312-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619894.390	2630382.265	32.7037560	-108.1347290	1474	1032	N		
6313-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619894.801	2630532.253	32.7037590	-108.1342420	2317	1622	N		
6314-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619895.213	2630682.273	32.7037610	-108.1337540	2521	1765	N		
6320-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619744.424	2630382.669	32.7033440	-108.1347270	536	375	N		
6321-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619744.798	2630532.658	32.7033470	-108.1342390	2441	1709	N		
6322-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619745.210	2630682.648	32.7033490	-108.1337520	1475	1033	N		
6328-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619594.421	2630383.042	32.7029320	-108.1347240	2160	1512	N		
6329-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619594.796	2630533.063	32.7029340	-108.1342360	1847	1293	N		
6330-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619595.207	2630683.053	32.7029360	-108.1337490	581	407	N		
6336-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619444.419	2630383.447	32.7025200	-108.1347210	489	342	N		
6337-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619444.793	2630533.437	32.7025220	-108.1342340	1239	867	N		
6338-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619445.205	2630683.428	32.7025240	-108.1337460	2443	1710	N		
6344-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619294.416	2630383.851	32.7021070	-108.1347190	319	223	N		
6345-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619294.791	2630533.842	32.7021100	-108.1342310	1708	1196	N		
6346-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619295.202	2630683.834	32.7021120	-108.1337430	1442	1009	N		

Footnotes:
[1]PreFS RAC for copper for small ground feeding bird applies to 0-6" soil sieved to < 2 mm (2000 µm). Pre-FS RAC for human health applies to 0-1" soil sieved to < 0.25 mm (250 µm). The ratio used to convert copper concentration of 0-1" sieved at <0.25 mm soils to 0-6" sieved at < 2 mm soils is from Appendix A (median ratio of SS samples) of Arcadis (2011). Multiplied copper concentration by 0.7 if outside windblown tailings (and by 1.5 if inside windblown tailings). If unsieved, multiplied by 0.9 if outside windblown tailings and by 1.3 if inside windblown tailings. The 0.9 and 1.3 are from median ratios of unsieved 0-1" soil in 2009 lab reports (at 25 m on transect) compared to sieved 0-6" co-located soil in Drexler lab report in Appendix D of the pH Monitoring Report (Appendix B to the FS Report) for soils in and outside of windblown tailings, respectively (FID 8, 18, 20 in tailings). A subset of the data collected using x-ray fluorescence as part of the Railroad Interim Removal Action (Golder 2013) was collected at 0-2 inch" and sieved at <0.25 mm; the same ratios described here were applied to these data to estimate 0 to 6 inch bgs.
[2]Data were collected for ecological endpoint and were not corrected to human health values.
[3]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as IRA.
[4]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as HWY 180.
[5]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as 2:1 slope.
[6]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as Volcanic Rock.
[7]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as NMDOT.
[8]If two samples were collected from the same location in the same sampling year (with identical sample location coordinates), an average was used in place of the two parent samples. For the co-located samples U04-1121 (SRK 2008) and FID 18 (Arcadis 2009), samples were collected in different years, and the sample from the more recent year was used (FID 18).
*Removed samples with the asterisk are set to 327 for the Theissens analysis. All other removed samples are completely voided.
-- means no data available at the location.

TABLE 3-2
STSIU Surface Soil Copper Results Adjusted to 0-6"

STSIU Feasibility Study
Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Location ID	Alternate ID	Source Report	Year Collected	Original Soil depth	Sieving Status	1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]	Northing (State Plane)	Easting (State Plane)	Latitude	Longitude	Copper Concentration[1] To Compare to HH Pre-FS RAC (250 µm sieve)	Copper Concentration[1] For Bird Pre-FS RAC Analysis (2000 µm sieve)	Pre-Interim Remedial Action (IRA) Dataset	Removed in Post-IRA Dataset	Reason Removed (also see this column's footnotes)
6350-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619144.413	2630384.224	32.7016950	-108.1347160	1477	1034	N		
6351-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619144.788	2630534.247	32.7016970	-108.1342280	1624	1137	N		
6352-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		619145.199	2630684.239	32.7017000	-108.1337410	1881	1317	N		
6354-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		618994.411	2630384.629	32.7012830	-108.1347130	1282	897	N		
6355-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		618994.822	2630534.621	32.7012850	-108.1342260	272	190	N		
6356-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		618995.197	2630684.614	32.7012870	-108.1337380	903	632	N		
6357-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		618844.408	2630385.033	32.7008710	-108.1347110	2152	1506	N		
6358-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		618844.819	2630535.026	32.7008730	-108.1342230	225	158	N		
6360-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		618694.406	2630385.406	32.7004580	-108.1347080	1803	1262	N		
6361-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		618694.816	2630535.431	32.7004600	-108.1342200	194	136	N		
6362-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		618094.432	2630386.993	32.6988090	-108.1346970	299	209	N		
6363-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		618094.806	2630536.990	32.6988110	-108.1342100	92	64	N		
6364-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		617944.429	2630387.397	32.6983970	-108.1346950	119	83	N		
6365-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		617944.804	2630537.395	32.6983990	-108.1342070	920	644	N		
6366-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		617945.215	2630687.393	32.6984010	-108.1337190	956	669	N		
6367-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		617794.427	2630387.802	32.6979840	-108.1346920	182	127	N		
6368-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		617794.801	2630537.800	32.6979870	-108.1342040	367	257	N		
6369-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		617795.213	2630687.798	32.6979890	-108.1337170	2250	1575	N		
6370-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		618083.826	2630675.696	32.6987820	-108.1337590	526	368	N		
6371-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620041.376	2630662.970	32.7041630	-108.1338180	1769	1238	N		
6372-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620195.152	2630666.358	32.7045850	-108.1338090	1515	1061	N		
6373-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620345.180	2630669.736	32.7049980	-108.1337990	2896	2027	N		
6382-EG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		620495.142	2630658.011	32.7054100	-108.1338380	2674	1872	N		
6383-NG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		623635.977	2632772.432	32.7140590	-108.1269930	368	258	N		
8000-SG		Golf Course Interim Removal Action, Arcadis 2009	2008	0-2"	0.25 mm sieve		621097.090	2631129.472	32.7070680	-108.1323110	3608	2526	N		
B-001		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620007.640	2634227.738	32.7040970	-108.1222290	835	734	N		
B-002		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620007.659	2634273.879	32.7040980	-108.1220790	329	268	N		
B-003		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620007.642	2634320.326	32.7040980	-108.1219280	1392	1275	N		
B-004		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620007.662	2634366.467	32.7040980	-108.1217780	1168	1055	N		
B-005		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620053.954	2634227.557	32.7042250	-108.1222300	487	410	N		
B-006		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620053.937	2634274.005	32.7042250	-108.1220790	1832	1716	N		
B-007		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620053.956	2634320.145	32.7042250	-108.1219290	209	164	N		
B-008		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620053.939	2634366.593	32.7042250	-108.1217780	1671	1553	N		
B-009		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620100.248	2634181.235	32.7043510	-108.1223810	240	190	N		
B-010		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620100.267	2634227.683	32.7043520	-108.1222300	3231	3169	N		
B-012		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620100.270	2634320.271	32.7043520	-108.1219290	1386	1269	N		
B-013		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620100.254	2634366.411	32.7043530	-108.1217790	2064	1952	N		
B-014		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620146.562	2634181.361	32.7044790	-108.1223810	2577	2481	N		
B-015		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620146.545	2634227.501	32.7044790	-108.1222310	1889	1774	N		
B-016		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620146.564	2634273.949	32.7044790	-108.1220800	191	149	N		
B-018		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620146.567	2634366.537	32.7044800	-108.1217790	2568	2472	N		
B-019		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620146.550	2634412.985	32.7044800	-108.1216280	3617	3580	N		
B-020		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620192.856	2634135.040	32.7046060	-108.1225320	313	254	N		
B-021		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620192.876	2634181.180	32.7046060	-108.1223820	67	48	N		
B-022		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620192.859	2634227.628	32.7046060	-108.1222310	657	567	N		
B-023		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620192.879	2634273.768	32.7046070	-108.1220810	5343	4808	N	Removed	Inaccessible
B-024		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620192.861	2634320.215	32.7046070	-108.1219300	1370	1253	N		

Footnotes:
[1]PreFS RAC for copper for small ground feeding bird applies to 0-6" soil sieved to < 2 mm (2000 µm). Pre-FS RAC for human health applies to 0-1" soil sieved to < 0.25 mm (250 µm). The ratio used to convert copper concentration of 0-1" sieved at <0.25 mm soils to 0-6" sieved at < 2 mm soils is from Appendix A (median ratio of SS samples) of Arcadis (2011). Multiplied copper concentration by 0.7 if outside windblown tailings (and by 1.5 if inside windblown tailings). If unsieved, multiplied by 0.9 if outside windblown tailings and by 1.3 if inside windblown tailings. The 0.9 and 1.3 are from median ratios of unsieved 0-1" soil in 2009 lab reports (at 25 m on transect) compared to sieved 0-6" co-located soil in Drexler lab report in Appendix D of the pH Monitoring Report (Appendix B to the FS Report) for soils in and outside of windblown tailings, respectively (FID 8, 18, 20 in tailings). A subset of the data collected using x-ray fluorescence as part of the Railroad Interim Removal Action (Golder 2013) was collected at 0-2 inch" and sieved at <0.25 mm; the same ratios described here were applied to these data to estimate 0 to 6 inch bgs.
[2]Data were collected for ecological endpoint and were not corrected to human health values.
[3]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as IRA.
[4]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as HWY 180.
[5]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as 2:1 slope.
[6]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as Volcanic Rock.
[7]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as NMDOT.
[8]If two samples were collected from the same location in the same sampling year (with identical sample location coordinates), an average was used in place of the two parent samples. For the co-located samples U04-1121 (SRK 2008) and FID 18 (Arcadis 2009), samples were collected in different years, and the sample from the more recent year was used (FID 18).
*Removed samples with the asterisk are set to 327 for the Theissens analysis. All other removed samples are completely voided.
-- means no data available at the location.

TABLE 3-2
STSIU Surface Soil Copper Results Adjusted to 0-6"

STSIU Feasibility Study
Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Location ID	Alternate ID	Source Report	Year Collected	Original Soil depth	Sieving Status	1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]	Northing (State Plane)	Easting (State Plane)	Latitude	Longitude	Copper Concentration[1] To Compare to HH Pre-FS RAC (250 µm sieve)	Copper Concentration[1] For Bird Pre-FS RAC Analysis (2000 µm sieve)	Pre-Interim Remedial Action (IRA) Dataset	Removed in Post-IRA Dataset	Reason Removed (also see this column's footnotes)
B-025		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620192.880	2634366.663	32.7046070	-108.1217790	268	215	N		
B-026		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620192.864	2634412.803	32.7046080	-108.1216290	244	194	N		
B-027		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620192.883	2634459.251	32.7046080	-108.1214780	459	384	N		
B-028		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620239.171	2634134.859	32.7047330	-108.1225330	69	49	N		
B-029		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620239.190	2634181.306	32.7047330	-108.1223820	1529	1411	N		
B-030		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620239.172	2634227.754	32.7047340	-108.1222310	145	111	N		
B-031		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620239.156	2634273.894	32.7047340	-108.1220810	3197	3133	N		
B-032		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620239.175	2634320.341	32.7047340	-108.1219300	1037	928	N		
B-033		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620239.158	2634366.481	32.7047350	-108.1217800	195	153	N		
B-034		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620239.178	2634412.929	32.7047350	-108.1216290	1835	1719	N		
B-035		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620239.161	2634459.069	32.7047350	-108.1214790	1645	1527	N		
B-036		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620239.181	2634505.516	32.7047360	-108.1213280	651	561	N		
B-037		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620285.465	2634088.845	32.7048600	-108.1226830	1561	1443	N		
B-038		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620285.484	2634134.985	32.7048600	-108.1225330	1410	1293	N		
B-039		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620285.467	2634181.432	32.7048610	-108.1223820	185	144	N		
B-040		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620285.486	2634227.572	32.7048610	-108.1222320	138	105	N		
B-042		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620285.489	2634320.160	32.7048620	-108.1219310	3475	3429	N		
B-043		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620285.472	2634366.607	32.7048620	-108.1217800	3047	2974	N		
B-044		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620285.492	2634412.747	32.7048620	-108.1216300	2188	2080	N		
B-045		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620285.475	2634459.195	32.7048630	-108.1214790	2142	2032	N		
B-046		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620285.495	2634505.335	32.7048630	-108.1213290	1374	1257	N		
B-047		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620331.773	2633718.314	32.7049840	-108.1238880	1355	1238	N		
B-048		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620331.779	2634088.664	32.7049870	-108.1226840	1936	1821	N		
B-049		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620331.798	2634135.111	32.7049880	-108.1225330	3608	3570	N		
B-050		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620331.781	2634181.251	32.7049880	-108.1223830	3046	2974	N		
B-051		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620331.800	2634227.699	32.7049880	-108.1222320	1066	955	N		
B-052		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620331.783	2634273.838	32.7049880	-108.1220820	1036	927	N		
B-053		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620331.766	2634320.286	32.7049890	-108.1219310	659	568	N		
B-059		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620378.087	2633718.134	32.7051120	-108.1238890	1851	1735	N		
B-060		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620378.105	2633764.581	32.7051120	-108.1237380	279	224	N		
B-061		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620378.090	2633996.203	32.7051140	-108.1229850	820	719	N		
B-062		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620378.074	2634042.343	32.7051140	-108.1228350	1052	942	N		
B-063		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620378.092	2634088.790	32.7051140	-108.1226840	2191	2082	N		
B-064		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620378.097	2634273.964	32.7051160	-108.1220820	1832	1716	N		
B-065		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620378.080	2634320.104	32.7051160	-108.1219320	3160	3094	N		
B-073		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620424.402	2633810.848	32.7052400	-108.1235880	2406	2304	N		
B-074		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620424.403	2633903.435	32.7052400	-108.1232870	3633	3597	N		
B-075		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620424.385	2633949.882	32.7052410	-108.1231360	2206	2098	N		
B-076		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620424.405	2633996.022	32.7052410	-108.1229860	549	467	N		
B-077		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620424.411	2634273.783	32.7052430	-108.1220830	3131	3063	N		
B-078		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620424.394	2634320.230	32.7052430	-108.1219320	423	351	N		
B-079		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620424.413	2634366.678	32.7052440	-108.1217810	3045	2972	N		
B-080		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620424.397	2634412.817	32.7052440	-108.1216310	3239	3177	N		
B-086		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620470.697	2633764.527	32.7053660	-108.1237390	3587	3547	N		
B-087		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620470.715	2633810.975	32.7053670	-108.1235880	88	65	N		
B-088		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620470.698	2633857.114	32.7053670	-108.1234380	141	107	N		
B-089		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620470.716	2633903.561	32.7053680	-108.1232870	627	538	N		

Footnotes:
[1]PreFS RAC for copper for small ground feeding bird applies to 0-6" soil sieved to < 2 mm (2000 µm). Pre-FS RAC for human health applies to 0-1" soil sieved to < 0.25 mm (250 µm). The ratio used to convert copper concentration of 0-1" sieved at <0.25 mm soils to 0-6" sieved at < 2 mm soils is from Appendix A (median ratio of SS samples) of Arcadis (2011). Multiplied copper concentration by 0.7 if outside windblown tailings (and by 1.5 if inside windblown tailings). If unsieved, multiplied by 0.9 if outside windblown tailings and by 1.3 if inside windblown tailings. The 0.9 and 1.3 are from median ratios of unsieved 0-1" soil in 2009 lab reports (at 25 m on transect) compared to sieved 0-6" co-located soil in Drexler lab report in Appendix D of the pH Monitoring Report (Appendix B to the FS Report) for soils in and outside of windblown tailings, respectively (FID 8, 18, 20 in tailings). A subset of the data collected using x-ray fluorescence as part of the Railroad Interim Removal Action (Golder 2013) was collected at 0-2 inch" and sieved at <0.25 mm; the same ratios described here were applied to these data to estimate 0 to 6 inch bgs.
[2]Data were collected for ecological endpoint and were not corrected to human health values.
[3]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as IRA.
[4]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as HWY 180.
[5]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as 2:1 slope.
[6]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as Volcanic Rock.
[7]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as NMDOT.
[8]If two samples were collected from the same location in the same sampling year (with identical sample location coordinates), an average was used in place of the two parent samples. For the co-located samples U04-1121 (SRK 2008) and FID 18 (Arcadis 2009), samples were collected in different years, and the sample from the more recent year was used (FID 18).
*Removed samples with the asterisk are set to 327 for the Theissens analysis. All other removed samples are completely voided.
-- means no data available at the location.

TABLE 3-2
STSIU Surface Soil Copper Results Adjusted to 0-6"

STSIU Feasibility Study
Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Location ID	Alternate ID	Source Report	Year Collected	Original Soil depth	Sieving Status	1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]	Northing (State Plane)	Easting (State Plane)	Latitude	Longitude	Copper Concentration[1] To Compare to HH Pre-FS RAC (250 µm sieve)	Copper Concentration[1] For Bird Pre-FS RAC Analysis (2000 µm sieve)	Pre-Interim Remedial Action (IRA) Dataset	Removed in Post-IRA Dataset	Reason Removed (also see this column's footnotes)
B-090		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620470.700	2633949.701	32.7053680	-108.1231370	914	809	N		
B-091		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620470.707	2634320.356	32.7053710	-108.1219320	1621	1504	N		
B-092		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620470.691	2634366.496	32.7053710	-108.1217820	40	28	N		
B-093		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620470.710	2634412.943	32.7053710	-108.1216310	60	42	N		
B-094		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620470.694	2634459.083	32.7053720	-108.1214810	54	38	N		
B-097		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620470.717	2634598.117	32.7053730	-108.1210290	2612	2518	N		
B-098		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620470.697	2635616.880	32.7053800	-108.1177170	2287	2181	N		
B-099		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620517.009	2633672.067	32.7054930	-108.1240400	2342	2238	N		
B-105		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620517.022	2634320.175	32.7054980	-108.1219330	538	456	N		
B-106		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620517.004	2634366.622	32.7054980	-108.1217820	517	437	N		
B-107		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620517.024	2634412.762	32.7054990	-108.1216320	180	140	N		
B-108		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620517.007	2634459.209	32.7054990	-108.1214810	2130	2020	N		
B-109		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620516.991	2634505.348	32.7054990	-108.1213310	1888	1773	N		
B-110		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620517.011	2634551.795	32.7055000	-108.1211800	397	329	N		
B-115		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620517.020	2635477.971	32.7055070	-108.1181690	723	628	N		
B-116		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620517.005	2635524.110	32.7055070	-108.1180190	383	316	N		
B-117		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620516.990	2635570.557	32.7055070	-108.1178680	506	427	N		
B-118		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620563.324	2633671.887	32.7056200	-108.1240410	3427	3377	N		
B-119		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620563.305	2633718.334	32.7056210	-108.1238900	4208	4217	N	Removed	Inaccessible
B-123		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620563.308	2633903.507	32.7056220	-108.1232880	3485	3439	N		
B-124		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620563.316	2634273.854	32.7056250	-108.1220840	704	610	N		
B-125		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620563.299	2634320.301	32.7056250	-108.1219330	2850	2767	N		
B-126		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620563.319	2634366.440	32.7056260	-108.1217830	77	56	N		
B-127		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620563.301	2634412.887	32.7056260	-108.1216320	433	360	N		
B-128		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620563.322	2634459.027	32.7056260	-108.1214820	141	107	N		
B-129		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620563.305	2634505.474	32.7056270	-108.1213310	105	78	N		
B-130		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620563.325	2634551.614	32.7056270	-108.1211810	2962	2884	N		
B-132		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620563.301	2635246.475	32.7056320	-108.1189220	2509	2411	N		
B-133		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620563.323	2635292.614	32.7056330	-108.1187720	1723	1606	N		
B-134		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620563.307	2635339.061	32.7056330	-108.1186210	3100	3030	N		
B-135		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620563.328	2635385.201	32.7056330	-108.1184710	3381	3328	N		
B-136		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620563.313	2635431.648	32.7056330	-108.1183200	795	696	N		
B-137		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620563.298	2635477.787	32.7056340	-108.1181700	735	640	N		
B-138		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620563.319	2635524.234	32.7056340	-108.1180190	917	812	N		
B-139		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620609.619	2633625.566	32.7057470	-108.1241920	1860	1744	N		
B-140		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620609.601	2633672.013	32.7057480	-108.1240410	3381	3328	N		
B-141		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620609.620	2633718.153	32.7057480	-108.1238910	1676	1558	N		
B-142		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620609.602	2633764.600	32.7057480	-108.1237400	2209	2101	N		
B-145		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620609.622	2633903.326	32.7057490	-108.1232890	2053	1941	N		
B-146		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620609.629	2634273.980	32.7057520	-108.1220840	570	486	N		
B-147		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620609.613	2634320.119	32.7057530	-108.1219340	2441	2340	N		
B-148		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620609.632	2634366.566	32.7057530	-108.1217830	2165	2056	N		
B-149		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620609.616	2634412.706	32.7057530	-108.1216330	104	78	N		
B-150		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620609.635	2634459.153	32.7057540	-108.1214820	1741	1624	N		
B-151		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620609.618	2634505.600	32.7057540	-108.1213310	1398	1282	N	Removed	Bedrock dust
B-152		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620609.602	2634551.739	32.7057540	-108.1211810	2122	2012	N		
B-153		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620609.621	2634598.186	32.7057550	-108.1210300	2235	2127	N		

Footnotes:
[1]PreFS RAC for copper for small ground feeding bird applies to 0-6" soil sieved to < 2 mm (2000 µm). Pre-FS RAC for human health applies to 0-1" soil sieved to < 0.25 mm (250 µm). The ratio used to convert copper concentration of 0-1" sieved at <0.25 mm soils to 0-6" sieved at < 2 mm soils is from Appendix A (median ratio of SS samples) of Arcadis (2011). Multiplied copper concentration by 0.7 if outside windblown tailings (and by 1.5 if inside windblown tailings). If unsieved, multiplied by 0.9 if outside windblown tailings and by 1.3 if inside windblown tailings. The 0.9 and 1.3 are from median ratios of unsieved 0-1" soil in 2009 lab reports (at 25 m on transect) compared to sieved 0-6" co-located soil in Drexler lab report in Appendix D of the pH Monitoring Report (Appendix B to the FS Report) for soils in and outside of windblown tailings, respectively (FID 8, 18, 20 in tailings). A subset of the data collected using x-ray fluorescence as part of the Railroad Interim Removal Action (Golder 2013) was collected at 0-2 inch" and sieved at <0.25 mm; the same ratios described here were applied to these data to estimate 0 to 6 inch bgs.
[2]Data were collected for ecological endpoint and were not corrected to human health values.
[3]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as IRA.
[4]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as HWY 180.
[5]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as 2:1 slope.
[6]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as Volcanic Rock.
[7]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as NMDOT.
[8]If two samples were collected from the same location in the same sampling year (with identical sample location coordinates), an average was used in place of the two parent samples. For the co-located samples U04-1121 (SRK 2008) and FID 18 (Arcadis 2009), samples were collected in different years, and the sample from the more recent year was used (FID 18).
*Removed samples with the asterisk are set to 327 for the Theissens analysis. All other removed samples are completely voided.
-- means no data available at the location.

TABLE 3-2
STSIU Surface Soil Copper Results Adjusted to 0-6"

STSIU Feasibility Study
Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Location ID	Alternate ID	Source Report	Year Collected	Original Soil depth	Sieving Status	1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]	Northing (State Plane)	Easting (State Plane)	Latitude	Longitude	Copper Concentration[1]: To Compare to HH Pre-FS RAC (250 µm sieve)	Copper Concentration[1]: For Bird Pre-FS RAC Analysis (2000 µm sieve)	Pre-Interim Remedial Action (IRA) Dataset	Removed in Post-IRA Dataset	Reason Removed (also see this column's footnotes)
B-154		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620609.605	2634644.326	32.7057550	-108.1208800	1669	1552	N		
B-155		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620609.625	2634690.773	32.7057550	-108.1207290	910	806	N		
B-156		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620609.609	2634736.912	32.7057560	-108.1205790	1219	1105	N		
B-157		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620609.629	2634783.359	32.7057560	-108.1204280	388	321	N		
B-158		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620609.613	2634829.499	32.7057560	-108.1202780	350	287	N		
B-159		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620609.626	2635107.566	32.7057580	-108.1193740	2966	2889	N		
B-161		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620609.631	2635200.152	32.7057590	-108.1190730	1934	1820	N		
B-162		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620609.616	2635246.292	32.7057590	-108.1189230	2831	2747	N		
B-163		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620609.600	2635292.739	32.7057600	-108.1187720	1983	1870	N		
B-164		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620609.621	2635338.878	32.7057600	-108.1186220	2881	2799	N		
B-166		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620655.932	2633625.693	32.7058750	-108.1241920	1101	990	N		
B-167		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620655.915	2633671.833	32.7058750	-108.1240420	1181	1068	N		
B-168		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620655.933	2633718.280	32.7058750	-108.1238910	858	756	N		
B-169		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620655.916	2633764.419	32.7058760	-108.1237410	1701	1584	N		
B-170		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620655.934	2633810.866	32.7058760	-108.1235900	224	177	N		
B-174		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620655.926	2634320.245	32.7058800	-108.1219340	185	144	N		
B-175		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620655.910	2634366.385	32.7058800	-108.1217840	3028	2954	N		
B-176		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620655.929	2634412.832	32.7058800	-108.1216330	572	488	N		
B-177		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620655.912	2634459.279	32.7058810	-108.1214820	1345	1228	N		
B-178		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620655.932	2634505.418	32.7058810	-108.1213320	1235	1121	N		
B-179		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620655.915	2634551.865	32.7058810	-108.1211810	2256	2149	N		
B-180		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620655.936	2634598.004	32.7058820	-108.1210310	1787	1671	N	Removed	Bedrock dust
B-181		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620655.919	2634644.451	32.7058820	-108.1208800	316	257	N		
B-182		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620655.939	2634690.591	32.7058830	-108.1207300	1763	1646	N		
B-183		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620655.923	2634737.038	32.7058830	-108.1205790	2267	2161	N		
B-184		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620655.907	2634783.177	32.7058830	-108.1204290	1499	1382	N		
B-185		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620655.927	2634829.624	32.7058840	-108.1202780	976	869	N		
B-186		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620655.911	2634875.763	32.7058840	-108.1201280	2309	2204	N		
B-187		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620655.931	2634922.210	32.7058840	-108.1199770	1466	1348	N		
B-188		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620655.915	2634968.350	32.7058850	-108.1198270	576	491	N		
B-189		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620655.935	2635014.797	32.7058850	-108.1196760	649	558	N		
B-190		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620655.919	2635061.244	32.7058850	-108.1195250	2166	2057	N		
B-191		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620655.940	2635107.383	32.7058860	-108.1193750	1813	1696	N		
B-194		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620655.929	2635246.416	32.7058870	-108.1189230	3512	3468	N		
B-195		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620655.914	2635292.556	32.7058870	-108.1187730	2731	2643	N		
B-196		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620655.935	2635339.003	32.7058870	-108.1186220	170	132	N		
B-197		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620702.247	2633625.513	32.7060020	-108.1241930	658	567	N		
B-198		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620702.228	2633671.960	32.7060020	-108.1240420	1346	1230	N		
B-199		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620702.247	2633718.099	32.7060030	-108.1238920	1578	1460	N		
B-200		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620702.229	2633764.546	32.7060030	-108.1237410	3603	3565	N		
B-201		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620702.211	2633810.993	32.7060030	-108.1235900	273	219	N		
B-202		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620702.231	2633857.132	32.7060040	-108.1234400	499	420	N		
B-203		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620702.213	2633903.579	32.7060040	-108.1232890	380	313	N		
B-206		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620702.240	2634320.371	32.7060070	-108.1219340	3203	3139	N		
B-207		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620702.224	2634366.511	32.7060070	-108.1217840	430	358	N		
B-208		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620702.243	2634412.958	32.7060080	-108.1216330	945	839	N		
B-209		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620702.226	2634459.097	32.7060080	-108.1214830	1161	1048	N		

Footnotes:
[1]PreFS RAC for copper for small ground feeding bird applies to 0-6" soil sieved to < 2 mm (2000 µm). Pre-FS RAC for human health applies to 0-1" soil sieved to < 0.25 mm (250 µm). The ratio used to convert copper concentration of 0-1" sieved at <0.25 mm soils to 0-6" sieved at < 2 mm soils is from Appendix A (median ratio of SS samples) of Arcadis (2011). Multiplied copper concentration by 0.7 if outside windblown tailings (and by 1.5 if inside windblown tailings). If unsieved, multiplied by 0.9 if outside windblown tailings and by 1.3 if inside windblown tailings. The 0.9 and 1.3 are from median ratios of unsieved 0-1" soil in 2009 lab reports (at 25 m on transect) compared to sieved 0-6" co-located soil in Drexler lab report in Appendix D of the pH Monitoring Report (Appendix B to the FS Report) for soils in and outside of windblown tailings, respectively (FID 8, 18, 20 in tailings). A subset of the data collected using x-ray fluorescence as part of the Railroad Interim Removal Action (Golder 2013) was collected at 0-2 inch" and sieved at <0.25 mm; the same ratios described here were applied to these data to estimate 0 to 6 inch bgs.
[2]Data were collected for ecological endpoint and were not corrected to human health values.
[3]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as IRA.
[4]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as HWY 180.
[5]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as 2:1 slope.
[6]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as Volcanic Rock.
[7]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as NMDOT.
[8]If two samples were collected from the same location in the same sampling year (with identical sample location coordinates), an average was used in place of the two parent samples. For the co-located samples U04-1121 (SRK 2008) and FID 18 (Arcadis 2009), samples were collected in different years, and the sample from the more recent year was used (FID 18).
*Removed samples with the asterisk are set to 327 for the Theissens analysis. All other removed samples are completely voided.
-- means no data available at the location.

TABLE 3-2
STSIU Surface Soil Copper Results Adjusted to 0-6"

STSIU Feasibility Study
Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Location ID	Alternate ID	Source Report	Year Collected	Original Soil depth	Sieving Status	1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]	Northing (State Plane)	Easting (State Plane)	Latitude	Longitude	Copper Concentration[1] To Compare to HH Pre-FS RAC (250 µm sieve)	Copper Concentration[1] For Bird Pre-FS RAC Analysis (2000 µm sieve)	Pre-Interim Remedial Action (IRA) Dataset	Removed in Post-IRA Dataset	Reason Removed (also see this column's footnotes)
B-210		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620702.246	2634505.544	32.7060090	-108.1213320	3324	3268	N		
B-211		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620702.230	2634551.683	32.7060090	-108.1211820	313	254	N		
B-212		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620702.213	2634598.130	32.7060090	-108.1210310	3451	3403	N		
B-213		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620702.233	2634644.269	32.7060100	-108.1208810	1855	1740	N		
B-214		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620702.216	2634690.716	32.7060100	-108.1207300	765	667	N		
B-215		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620702.237	2634736.856	32.7060100	-108.1205800	3511	3466	N		
B-216		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620702.220	2634783.302	32.7060100	-108.1204290	5700	5854	N	Removed	Bedrock dust
B-217		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620702.241	2634829.442	32.7060110	-108.1202790	6517	6766	N	Removed	Bedrock dust
B-218		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620702.224	2634875.889	32.7060110	-108.1201280	1375	1258	N		
B-219		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620702.244	2634922.336	32.7060120	-108.1199770	621	532	N		
B-220		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620702.229	2634968.475	32.7060120	-108.1198270	323	263	N		
B-221		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620702.212	2635014.922	32.7060120	-108.1196760	2814	2729	N		
B-222		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620702.233	2635061.061	32.7060130	-108.1195260	1303	1187	N		
B-223		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620702.217	2635107.508	32.7060130	-108.1193750	3347	3292	N		
B-226		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620702.243	2635246.234	32.7060140	-108.1189240	2650	2558	N		
B-227		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620702.228	2635292.680	32.7060140	-108.1187730	149	114	N		
B-228		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620748.524	2633625.640	32.7061290	-108.1241930	1998	1885	N		
B-229		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620748.542	2633672.087	32.7061300	-108.1240420	1597	1479	N		
B-230		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620748.525	2633718.226	32.7061300	-108.1238920	1088	977	N		
B-231		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620748.543	2633764.673	32.7061300	-108.1237410	163	125	N		
B-232		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620748.526	2633810.812	32.7061310	-108.1235910	410	340	N		
B-233		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620748.544	2633857.259	32.7061310	-108.1234400	897	793	N		
B-234		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620748.527	2633903.398	32.7061310	-108.1232900	696	603	N		
B-237		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620748.547	2634042.431	32.7061320	-108.1228380	1954	1840	N		
B-238		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620748.518	2634320.190	32.7061340	-108.1219350	2058	1946	N		
B-239		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620748.537	2634366.637	32.7061350	-108.1217840	2510	2412	N		
B-240		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620748.521	2634412.776	32.7061350	-108.1216340	275	221	N		
B-241		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620748.540	2634459.223	32.7061350	-108.1214830	1275	1160	N		
B-242		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620748.524	2634505.362	32.7061360	-108.1213330	1291	1175	N		
B-243		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620748.543	2634551.809	32.7061360	-108.1211820	1123	1011	N		
B-244		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620748.527	2634597.948	32.7061360	-108.1210320	2513	2415	N		
B-245		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620748.547	2634644.395	32.7061370	-108.1208810	162	124	N		
B-246		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620748.531	2634690.534	32.7061370	-108.1207310	343	280	N		
B-247		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620748.518	2634829.567	32.7061380	-108.1202790	138	105	N		
B-248		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620748.538	2634876.014	32.7061390	-108.1201280	3599	3561	N		
B-249		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620748.522	2634922.153	32.7061390	-108.1199780	1011	902	N		
B-250		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620748.542	2634968.600	32.7061390	-108.1198270	2451	2350	N		
B-251		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620748.527	2635014.739	32.7061390	-108.1196770	2023	1910	N		
B-252		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620748.547	2635061.186	32.7061400	-108.1195260	2778	2692	N		
B-253		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620748.531	2635107.325	32.7061400	-108.1193760	2289	2183	N		
B-254		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620748.552	2635153.772	32.7061410	-108.1192250	2973	2897	N		
B-255		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620748.537	2635199.911	32.7061410	-108.1190750	2362	2258	N		
B-256		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620748.521	2635246.358	32.7061410	-108.1189240	2122	2012	N	Removed	Bedrock dust
B-257		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620748.542	2635292.498	32.7061420	-108.1187740	776	678	N		
B-258		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620794.855	2633579.320	32.7062560	-108.1243440	143	109	N		
B-259		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620794.837	2633625.767	32.7062560	-108.1241930	741	645	N		
B-260		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620794.856	2633671.906	32.7062570	-108.1240430	1057	947	N		

Footnotes:
[1]PreFS RAC for copper for small ground feeding bird applies to 0-6" soil sieved to < 2 mm (2000 µm). Pre-FS RAC for human health applies to 0-1" soil sieved to < 0.25 mm (250 µm). The ratio used to convert copper concentration of 0-1" sieved at <0.25 mm soils to 0-6" sieved at < 2 mm soils is from Appendix A (median ratio of SS samples) of Arcadis (2011). Multiplied copper concentration by 0.7 if outside windblown tailings (and by 1.5 if inside windblown tailings). If unsieved, multiplied by 0.9 if outside windblown tailings and by 1.3 if inside windblown tailings. The 0.9 and 1.3 are from median ratios of unsieved 0-1" soil in 2009 lab reports (at 25 m on transect) compared to sieved 0-6" co-located soil in Drexler lab report in Appendix D of the pH Monitoring Report (Appendix B to the FS Report) for soils in and outside of windblown tailings, respectively (FID 8, 18, 20 in tailings). A subset of the data collected using x-ray fluorescence as part of the Railroad Interim Removal Action (Golder 2013) was collected at 0-2 inch" and sieved at <0.25 mm; the same ratios described here were applied to these data to estimate 0 to 6 inch bgs.
[2]Data were collected for ecological endpoint and were not corrected to human health values.
[3]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as IRA.
[4]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as HWY 180.
[5]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as 2:1 slope.
[6]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as Volcanic Rock.
[7]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as NMDOT.
[8]If two samples were collected from the same location in the same sampling year (with identical sample location coordinates), an average was used in place of the two parent samples. For the co-located samples U04-1121 (SRK 2008) and FID 18 (Arcadis 2009), samples were collected in different years, and the sample from the more recent year was used (FID 18).
*Removed samples with the asterisk are set to 327 for the Theissens analysis. All other removed samples are completely voided.
-- means no data available at the location.

TABLE 3-2
STSIU Surface Soil Copper Results Adjusted to 0-6”

STSIU Feasibility Study
Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Location ID	Alternate ID	Source Report	Year Collected	Original Soil depth	Sieving Status	1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]	Northing (State Plane)	Easting (State Plane)	Latitude	Longitude	Copper Concentration[1] To Compare to HH Pre-FS RAC (250 µm sieve)	Copper Concentration[1] For Bird Pre-FS RAC Analysis (2000 µm sieve)	Pre-Interim Remedial Action (IRA) Dataset	Removed in Post-IRA Dataset	Reason Removed (also see this column's footnotes)
B-261		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620794.838	2633718.353	32.7062570	-108.1238920	1880	1765	N		
B-262		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620794.857	2633764.492	32.7062570	-108.1237420	1809	1693	N		
B-263		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620794.839	2633810.939	32.7062580	-108.1235910	1445	1328	N		
B-264		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620794.858	2633857.078	32.7062580	-108.1234410	1678	1561	N		
B-265		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620794.841	2633903.525	32.7062580	-108.1232900	1922	1807	N		
B-266		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620794.824	2633949.664	32.7062590	-108.1231400	3199	3135	N		
B-267		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620794.842	2633996.111	32.7062590	-108.1229890	113	85	N		
B-268		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620794.825	2634042.250	32.7062600	-108.1228390	218	172	N		
B-269		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620794.844	2634088.697	32.7062600	-108.1226880	840	739	N		
B-270		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620794.831	2634320.316	32.7062620	-108.1219350	1289	1174	N		
B-271		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620794.851	2634366.455	32.7062620	-108.1217850	2343	2239	N		
B-272		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620794.834	2634412.902	32.7062620	-108.1216340	978	871	N		
B-273		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620794.854	2634459.041	32.7062630	-108.1214840	1152	1039	N		
B-274		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620794.837	2634505.488	32.7062630	-108.1213330	3489	3443	N		
B-275		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620794.857	2634551.627	32.7062630	-108.1211830	3413	3362	N		
B-276		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620794.841	2634598.074	32.7062640	-108.1210320	2757	2670	N		
B-277		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620794.856	2634968.418	32.7062660	-108.1198280	2196	2087	N		
B-278		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620794.840	2635014.864	32.7062670	-108.1196770	1189	1075	N		
B-279		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620794.825	2635061.003	32.7062670	-108.1195270	1914	1799	N		
B-280		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620794.845	2635107.450	32.7062680	-108.1193760	2227	2119	N		
B-281		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620794.830	2635153.589	32.7062680	-108.1192260	1284	1169	N		
B-282		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620794.850	2635200.036	32.7062680	-108.1190750	2906	2826	N		
B-283		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620794.834	2635246.483	32.7062690	-108.1189240	2396	2294	N		
B-284		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620841.133	2633579.447	32.7063830	-108.1243440	1839	1723	N	Removed	Bedrock dust
B-285		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620841.152	2633625.586	32.7063840	-108.1241940	1022	913	N		
B-286		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620841.133	2633672.033	32.7063840	-108.1240430	507	428	N		
B-287		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620841.152	2633718.172	32.7063840	-108.1238930	1010	902	N		
B-288		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620841.134	2633764.619	32.7063850	-108.1237420	990	882	N		
B-289		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620841.153	2633810.758	32.7063850	-108.1235920	892	788	N		
B-290		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620841.135	2633857.205	32.7063850	-108.1234410	2281	2175	N		
B-291		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620841.155	2633903.344	32.7063860	-108.1232910	659	568	N		
B-292		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620841.137	2633949.791	32.7063860	-108.1231400	1690	1573	N		
B-293		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620841.156	2633996.237	32.7063870	-108.1229890	1273	1158	N		
B-294		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620841.139	2634042.377	32.7063870	-108.1228390	1231	1117	N		
B-295		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620841.157	2634088.823	32.7063870	-108.1226880	2403	2301	N		
B-296		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620841.141	2634134.962	32.7063870	-108.1225380	912	807	N		
B-297		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620841.160	2634181.409	32.7063880	-108.1223870	1224	1109	N		
B-298		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620841.146	2634320.134	32.7063890	-108.1219360	582	497	N		
B-299		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620841.128	2634366.581	32.7063890	-108.1217850	990	882	N		
B-300		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620841.148	2634412.720	32.7063900	-108.1216350	934	828	N		
B-301		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620841.131	2634459.167	32.7063900	-108.1214840	944	838	N		
B-302		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620841.151	2634505.306	32.7063900	-108.1213340	1179	1065	N		
B-303		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620841.134	2634551.753	32.7063910	-108.1211830	370	305	N		
B-304		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620841.134	2634968.543	32.7063940	-108.1198280	228	180	N		
B-305		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620841.154	2635014.682	32.7063940	-108.1196780	2436	2335	N		
B-306		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620841.138	2635061.128	32.7063940	-108.1195270	2958	2880	N		
B-308		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620841.143	2635153.714	32.7063950	-108.1192260	1741	1624	N		

Footnotes:
[1]PreFS RAC for copper for small ground feeding bird applies to 0-6" soil sieved to < 2 mm (2000 µm). Pre-FS RAC for human health applies to 0-1" soil sieved to < 0.25 mm (250 µm). The ratio used to convert copper concentration of 0-1" sieved at <0.25 mm soils to 0-6" sieved at < 2 mm soils is from Appendix A (median ratio of SS samples) of Arcadis (2011). Multiplied copper concentration by 0.7 if outside windblown tailings (and by 1.5 if inside windblown tailings). If unsieved, multiplied by 0.9 if outside windblown tailings and by 1.3 if inside windblown tailings. The 0.9 and 1.3 are from median ratios of unsieved 0-1" soil in 2009 lab reports (at 25 m on transect) compared to sieved 0-6" co-located soil in Drexler lab report in Appendix D of the pH Monitoring Report (Appendix B to the FS Report) for soils in and outside of windblown tailings, respectively (FID 8, 18, 20 in tailings). A subset of the data collected using x-ray fluorescence as part of the Railroad Interim Removal Action (Golder 2013) was collected at 0-2 inch" and sieved at <0.25 mm; the same ratios described here were applied to these data to estimate 0 to 6 inch bgs.
[2]Data were collected for ecological endpoint and were not corrected to human health values.
[3]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as IRA.
[4]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as HWY 180.
[5]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as 2:1 slope.
[6]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as Volcanic Rock.
[7]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as NMDOT.
[8]If two samples were collected from the same location in the same sampling year (with identical sample location coordinates), an average was used in place of the two parent samples. For the co-located samples U04-1121 (SRK 2008) and FID 18 (Arcadis 2009), samples were collected in different years, and the sample from the more recent year was used (FID 18).
*Removed samples with the asterisk are set to 327 for the Theissens analysis. All other removed samples are completely voided.
-- means no data available at the location.

TABLE 3-2
STSIU Surface Soil Copper Results Adjusted to 0-6"

STSIU Feasibility Study
Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Location ID	Alternate ID	Source Report	Year Collected	Original Soil depth	Sieving Status	1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]	Northing (State Plane)	Easting (State Plane)	Latitude	Longitude	Copper Concentration[1] To Compare to HH Pre-FS RAC (250 µm sieve)	Copper Concentration[1] For Bird Pre-FS RAC Analysis (2000 µm sieve)	Pre-Interim Remedial Action (IRA) Dataset	Removed in Post-IRA Dataset	Reason Removed (also see this column's footnotes)
B-309		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620841.163	2635200.161	32.7063950	-108.1190750	1690	1573	N		
B-310		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620841.148	2635246.300	32.7063960	-108.1189250	3394	3342	N		
B-311		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620887.447	2633579.267	32.7065110	-108.1243450	1598	1481	N		
B-312		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620887.465	2633625.713	32.7065110	-108.1241940	3534	3492	N		
B-313		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620887.448	2633671.852	32.7065110	-108.1240440	1685	1567	N		
B-314		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620887.466	2633718.299	32.7065120	-108.1238930	2172	2062	N		
B-315		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620887.449	2633764.438	32.7065120	-108.1237430	766	669	N		
B-316		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620887.467	2633810.885	32.7065120	-108.1235920	2350	2247	N		
B-317		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620887.450	2633857.024	32.7065130	-108.1234420	1110	999	N		
B-318		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620887.468	2633903.471	32.7065130	-108.1232910	2684	2593	N		
B-319		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620887.450	2633949.917	32.7065130	-108.1231400	1753	1636	N		
B-320		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620887.470	2633996.056	32.7065140	-108.1229900	2828	2743	N		
B-321		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620887.452	2634042.503	32.7065140	-108.1228390	3133	3065	N		
B-322		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620887.435	2634088.642	32.7065140	-108.1226890	3127	3059	N		
B-323		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620887.454	2634135.089	32.7065150	-108.1225380	336	275	N		
B-324		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620887.438	2634181.228	32.7065150	-108.1223880	3046	2974	N		
B-325		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620887.457	2634227.674	32.7065160	-108.1222370	3371	3318	N		
B-326		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620887.459	2634320.260	32.7065160	-108.1219360	1323	1207	N		
B-327		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620887.443	2634366.399	32.7065160	-108.1217860	1962	1848	N		
B-328		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620887.462	2634412.846	32.7065170	-108.1216350	2944	2865	N		
B-329		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620887.457	2635153.839	32.7065220	-108.1192260	148	113	N		
B-330		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620887.441	2635199.978	32.7065230	-108.1190760	2242	2134	N		
B-331		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620933.760	2633579.394	32.7066380	-108.1243450	1892	1776	N		
B-332		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620933.743	2633625.533	32.7066380	-108.1241950	1140	1028	N		
B-333		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620933.761	2633671.979	32.7066390	-108.1240440	1784	1668	N		
B-334		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620933.744	2633718.118	32.7066390	-108.1238940	799	700	N		
B-335		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620933.762	2633764.565	32.7066390	-108.1237430	658	567	N		
B-336		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620933.755	2635200.103	32.7066500	-108.1190760	405	336	N		
B-337		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620980.056	2633533.074	32.7067650	-108.1244960	730	635	N		
B-338		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620980.075	2633579.213	32.7067650	-108.1243460	3045	2972	N		
B-339		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620980.056	2633625.660	32.7067660	-108.1241950	2626	2532	N		
B-340		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620980.075	2633671.799	32.7067660	-108.1240450	2399	2297	N		
B-341		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620980.057	2633718.245	32.7067660	-108.1238940	2688	2598	N		
B-342		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620980.076	2633764.692	32.7067670	-108.1237430	3356	3301	N		
B-343		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620980.048	2635153.781	32.7067770	-108.1192270	344	281	N		
B-344		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621026.370	2633532.894	32.7068920	-108.1244970	929	824	N		
B-345		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621026.352	2633579.340	32.7068920	-108.1243460	929	824	N		
B-346		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621026.370	2633625.787	32.7068930	-108.1241950	1571	1453	N		
B-347		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621026.352	2633671.926	32.7068930	-108.1240450	1245	1131	N		
B-348		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621026.371	2633718.372	32.7068930	-108.1238940	1899	1784	N		
B-349		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621026.378	2635107.460	32.7069040	-108.1193780	743	647	N		
B-350		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621026.362	2635153.598	32.7069040	-108.1192280	2215	2107	N		
B-351		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621072.684	2633533.021	32.7070190	-108.1244970	313	254	N		
B-352		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621072.665	2633579.467	32.7070200	-108.1243460	2450	2350	N		
B-353		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621072.684	2633625.606	32.7070200	-108.1241960	2949	2871	N		
B-354		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621072.666	2633672.053	32.7070200	-108.1240450	1874	1758	N		
B-355		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621072.685	2633718.191	32.7070210	-108.1238950	746	649	N		

Footnotes:
[1]PreFS RAC for copper for small ground feeding bird applies to 0-6" soil sieved to < 2 mm (2000 µm). Pre-FS RAC for human health applies to 0-1" soil sieved to < 0.25 mm (250 µm). The ratio used to convert copper concentration of 0-1" sieved at <0.25 mm soils to 0-6" sieved at < 2 mm soils is from Appendix A (median ratio of SS samples) of Arcadis (2011). Multiplied copper concentration by 0.7 if outside windblown tailings (and by 1.5 if inside windblown tailings). If unsieved, multiplied by 0.9 if outside windblown tailings and by 1.3 if inside windblown tailings. The 0.9 and 1.3 are from median ratios of unsieved 0-1" soil in 2009 lab reports (at 25 m on transect) compared to sieved 0-6" co-located soil in Drexler lab report in Appendix D of the pH Monitoring Report (Appendix B to the FS Report) for soils in and outside of windblown tailings, respectively (FID 8, 18, 20 in tailings). A subset of the data collected using x-ray fluorescence as part of the Railroad Interim Removal Action (Golder 2013) was collected at 0-2 inch" and sieved at <0.25 mm; the same ratios described here were applied to these data to estimate 0 to 6 inch bgs.
[2]Data were collected for ecological endpoint and were not corrected to human health values.
[3]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as IRA.
[4]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as HWY 180.
[5]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as 2:1 slope.
[6]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as Volcanic Rock.
[7]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as NMDOT.
[8]If two samples were collected from the same location in the same sampling year (with identical sample location coordinates), an average was used in place of the two parent samples. For the co-located samples U04-1121 (SRK 2008) and FID 18 (Arcadis 2009), samples were collected in different years, and the sample from the more recent year was used (FID 18).
*Removed samples with the asterisk are set to 327 for the Theissens analysis. All other removed samples are completely voided.
-- means no data available at the location.

TABLE 3-2
STSIU Surface Soil Copper Results Adjusted to 0-6"

STSIU Feasibility Study
Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Location ID	Alternate ID	Source Report	Year Collected	Original Soil depth	Sieving Status	1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]	Northing (State Plane)	Easting (State Plane)	Latitude	Longitude	Copper Concentration[1] To Compare to HH Pre-FS RAC (250 µm sieve)	Copper Concentration[1] For Bird Pre-FS RAC Analysis (2000 µm sieve)	Pre-Interim Remedial Action (IRA) Dataset	Removed in Post-IRA Dataset	Reason Removed (also see this column's footnotes)
B-356		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621072.671	2635061.138	32.7070310	-108.1195290	1186	1072	N	Removed	Bedrock dust
B-357		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621072.692	2635107.277	32.7070310	-108.1193790	1096	985	N		
B-358		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621118.997	2633533.148	32.7071470	-108.1244970	808	708	N		
B-359		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621118.980	2633579.287	32.7071470	-108.1243470	171	132	N		
B-360		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621118.998	2633625.733	32.7071470	-108.1241960	3146	3079	N		
B-361		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621118.980	2633671.872	32.7071480	-108.1240460	2029	1916	N		
B-362		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621118.964	2635014.817	32.7071580	-108.1196800	447	373	N	Removed	Bedrock dust
B-363		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621118.984	2635061.263	32.7071580	-108.1195290	1095	984	N		
B-364		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621118.969	2635107.402	32.7071580	-108.1193790	1395	1278	N		
B-365		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621165.278	2635014.942	32.7072850	-108.1196800	1540	1422	N	Removed	Bedrock dust
B-366		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621165.299	2635061.081	32.7072850	-108.1195300	1575	1458	N		
B-367		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621165.282	2635107.527	32.7072860	-108.1193790	1142	1030	N		
B-368		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621211.607	2634968.621	32.7074120	-108.1198310	869	767	N	Removed	Bedrock dust
B-369		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621211.592	2635014.759	32.7074120	-108.1196810	728	632	N		
B-370		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621211.576	2635061.205	32.7074130	-108.1195300	476	399	N		
B-371		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621257.901	2634922.300	32.7075390	-108.1199820	2916	2836	N	Removed	Bedrock dust
B-372		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621257.885	2634968.438	32.7075390	-108.1198320	3287	3228	N	Removed	Bedrock dust
B-373		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621257.905	2635014.884	32.7075400	-108.1196810	391	323	N		
B-374		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621257.890	2635061.023	32.7075400	-108.1195310	350	287	N		
B-375		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621304.215	2634922.117	32.7076660	-108.1199830	2670	2579	N	Removed	Bedrock dust
B-376		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621304.199	2634968.563	32.7076670	-108.1198320	1352	1236	N		
B-377		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621304.220	2635014.702	32.7076670	-108.1196820	1356	1240	N		
B-378		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621350.509	2634875.797	32.7077930	-108.1201340	779	681	N	Removed	Bedrock dust
B-379		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621350.492	2634922.242	32.7077930	-108.1199830	1567	1449	N		
B-380		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621350.513	2634968.381	32.7077940	-108.1198330	2808	2723	N		
B-381		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621396.802	2634829.476	32.7079200	-108.1202850	2079	1968	N	Removed	Bedrock dust
B-382		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621396.822	2634875.922	32.7079200	-108.1201340	2403	2301	N		
B-383		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621396.807	2634922.060	32.7079210	-108.1199840	730	635	N		
B-384		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621443.132	2634783.155	32.7080470	-108.1204360	2452	2352	N	Removed	Bedrock dust
B-385		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621443.116	2634829.601	32.7080470	-108.1202850	385	317	N		
B-386		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621443.137	2634875.739	32.7080480	-108.1201350	1758	1641	N		
B-387		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621271.670	2634983.547	32.7075770	-108.1197830	651	561	N		
B-388		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621275.483	2635026.497	32.7075880	-108.1196430	259	207	N		
B-389		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621320.869	2634885.159	32.7077120	-108.1201030	6292	6514	N	Removed	Bedrock dust
B-390		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621322.782	2634931.241	32.7077170	-108.1199530	191	149	N		
B-391		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621324.694	2634977.324	32.7077230	-108.1198040	1226	1112	N		
B-393		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621370.057	2634885.169	32.7078470	-108.1201040	1127	1015	N		
B-394		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621371.969	2634931.251	32.7078530	-108.1199540	621	532	N		
B-395		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621423.069	2634829.731	32.7079920	-108.1202840	2392	2289	N		
B-396		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621423.082	2634878.915	32.7079930	-108.1201250	737	641	N		
B-397		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620336.835	2633650.134	32.7049980	-108.1241100	1365	1249	N		
B-398		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620386.349	2633650.485	32.7051340	-108.1241090	2189	2080	N		
B-399		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620437.849	2633643.305	32.7052750	-108.1241330	1043	933	N		
B-400		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620488.446	2633646.889	32.7054140	-108.1241220	270	216	N		
B-401		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620539.809	2633596.830	32.7055550	-108.1242850	3425	3375	N		
B-402		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620592.547	2633602.142	32.7057000	-108.1242680	771	673	N		
B-403		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620635.695	2633602.476	32.7058190	-108.1242670	1029	920	N		

Footnotes:
[1]PreFS RAC for copper for small ground feeding bird applies to 0-6" soil sieved to < 2 mm (2000 µm). Pre-FS RAC for human health applies to 0-1" soil sieved to < 0.25 mm (250 µm). The ratio used to convert copper concentration of 0-1" sieved at <0.25 mm soils to 0-6" sieved at < 2 mm soils is from Appendix A (median ratio of SS samples) of Arcadis (2011). Multiplied copper concentration by 0.7 if outside windblown tailings (and by 1.5 if inside windblown tailings). If unsieved, multiplied by 0.9 if outside windblown tailings and by 1.3 if inside windblown tailings. The 0.9 and 1.3 are from median ratios of unsieved 0-1" soil in 2009 lab reports (at 25 m on transect) compared to sieved 0-6" co-located soil in Drexler lab report in Appendix D of the pH Monitoring Report (Appendix B to the FS Report) for soils in and outside of windblown tailings, respectively (FID 8, 18, 20 in tailings). A subset of the data collected using x-ray fluorescence as part of the Railroad Interim Removal Action (Golder 2013) was collected at 0-2 inch" and sieved at <0.25 mm; the same ratios described here were applied to these data to estimate 0 to 6 inch bgs.
[2]Data were collected for ecological endpoint and were not corrected to human health values.
[3]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as IRA.
[4]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as HWY 180.
[5]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as 2:1 slope.
[6]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as Volcanic Rock.
[7]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as NMDOT.
[8]If two samples were collected from the same location in the same sampling year (with identical sample location coordinates), an average was used in place of the two parent samples. For the co-located samples U04-1121 (SRK 2008) and FID 18 (Arcadis 2009), samples were collected in different years, and the sample from the more recent year was used (FID 18).
*Removed samples with the asterisk are set to 327 for the Theissens analysis. All other removed samples are completely voided.
-- means no data available at the location.

TABLE 3-2
STSIU Surface Soil Copper Results Adjusted to 0-6"

STSIU Feasibility Study
Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Location ID	Alternate ID	Source Report	Year Collected	Original Soil depth	Sieving Status	1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]	Northing (State Plane)	Easting (State Plane)	Latitude	Longitude	Copper Concentration[1] To Compare to HH Pre-FS RAC (250 µm sieve)	For Bird Pre-FS RAC Analysis (2000 µm sieve)	Pre-Interim Remedial Action (IRA) Dataset	Removed in Post-IRA Dataset	Reason Removed (also see this column's footnotes)
B-404		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620687.795	2633601.788	32.7059620	-108.1242700	284	228	N		
B-405		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620690.437	2633553.995	32.7059690	-108.1244250	2846	2763	N		
B-406		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620732.755	2633551.774	32.7060850	-108.1244330	2090	1979	N		
B-407		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620784.120	2633553.883	32.7062260	-108.1244270	600	513	N		
B-408		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620832.320	2633555.954	32.7063590	-108.1244200	3576	3536	N		
B-409		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620879.738	2633551.316	32.7064890	-108.1244360	1913	1798	N		
B-410		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620930.945	2633504.918	32.7066300	-108.1245870	759	662	N		
B-411		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620980.576	2633502.686	32.7067660	-108.1245950	1023	914	N		
B-412		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621032.668	2633505.013	32.7069090	-108.1245880	915	810	N		
B-413		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620384.967	2633756.541	32.7051310	-108.1237640	249	199	N		
B-414		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621130.294	2633460.188	32.7071770	-108.1247340	155	119	N		
B-415		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620881.268	2634282.379	32.7064990	-108.1220590	1841	1725	N		
B-416		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620833.710	2634285.079	32.7063680	-108.1220500	106	79	N		
B-417		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620784.444	2634286.852	32.7062330	-108.1220440	1928	1813	N		
B-418		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620384.975	2634006.557	32.7051330	-108.1229510	2599	2504	N		
BX-038		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620238.544	2634098.037	32.7047310	-108.1226530	436	364	N		
BX-063		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620533.764	2634639.229	32.7055460	-108.1208960	1249	1134	N		
BX-065		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620584.864	2634685.323	32.7056870	-108.1207460	2288	2182	N		
BX-066		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620584.852	2634783.723	32.7056880	-108.1204270	1441	1324	N		
BX-070		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620634.053	2634980.502	32.7058250	-108.1197870	1731	1614	N		
BX-071		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620634.066	2635029.718	32.7058250	-108.1196270	2845	2761	N		
BX-077		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620535.645	2635275.714	32.7055560	-108.1188270	500	421	N		
BX-079		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620486.434	2635324.920	32.7054210	-108.1186660	50	35	N		
BX-087		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620582.950	2635475.625	32.7056880	-108.1181770	1109	997	N		
BX-098		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621122.361	2635131.249	32.7071680	-108.1193020	1721	1604	N		
BX-111		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621222.541	2634934.446	32.7074420	-108.1199420	3292	3233	N	Removed	Bedrock dust
BX-116		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621074.930	2635032.846	32.7070370	-108.1196210	2954	2876	N		
BX-120		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620978.467	2635078.909	32.7067720	-108.1194700	2236	2129	N		
BX-121		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620927.343	2635082.031	32.7066320	-108.1194600	3507	3463	N		
BX-122		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620929.256	2635128.114	32.7066370	-108.1193100	2126	2016	N		
BX-134		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		620976.559	2633999.622	32.7067590	-108.1229790	1140	1027	N		
BX-169		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621175.239	2633455.328	32.7073010	-108.1247510	246	196	N		
BX-171		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621224.463	2633455.310	32.7074360	-108.1247510	2548	2451	N		
BX-172		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621273.641	2633406.107	32.7075710	-108.1249110	1916	1802	N		
BX-175		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621320.965	2633409.221	32.7077010	-108.1249020	233	185	N		
BX-188		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621421.267	2633356.930	32.7079760	-108.1250730	1152	1039	N		
BX-195		B Ranch Interim Removal Action, Arcadis 2020	2019	shallow	2 mm sieve		621468.555	2633360.044	32.7081060	-108.1250630	862	759	N		
RR001		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		617981.035	2630116.794	32.6984950	-108.1355750	2,282	1597	N		
RR004		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		618115.536	2630117.547	32.6988650	-108.1355740	2,366	1656	N		
RR005		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		618112.973	2629982.956	32.6988570	-108.1360110	2,076	1453	N		
RR006		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		618246.990	2630000.103	32.6992250	-108.1359570	2,156	1509	N		
RR007		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		618246.808	2630114.906	32.6992260	-108.1355830	1,078	755	N		
RR008		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		618245.917	2630364.198	32.6992250	-108.1347730	3,329	2330	N		
RR009		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		618377.344	2630358.266	32.6995870	-108.1347930	3,777	2644	N		
RR010		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		618378.035	2630115.557	32.6995870	-108.1355820	1,741	1219	N		
RR011		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		618509.225	2630116.177	32.6999470	-108.1355820	1,531	1072	N		
RR012		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		618511.207	2630378.672	32.6999550	-108.1347280	2,839	1987	N		

Footnotes:
[1]PreFS RAC for copper for small ground feeding bird applies to 0-6" soil sieved to < 2 mm (2000 µm). Pre-FS RAC for human health applies to 0-1" soil sieved to < 0.25 mm (250 µm). The ratio used to convert copper concentration of 0-1" sieved at <0.25 mm soils to 0-6" sieved at < 2 mm soils is from Appendix A (median ratio of SS samples) of Arcadis (2011). Multiplied copper concentration by 0.7 if outside windblown tailings (and by 1.5 if inside windblown tailings). If unsieved, multiplied by 0.9 if outside windblown tailings and by 1.3 if inside windblown tailings. The 0.9 and 1.3 are from median ratios of unsieved 0-1" soil in 2009 lab reports (at 25 m on transect) compared to sieved 0-6" co-located soil in Drexler lab report in Appendix D of the pH Monitoring Report (Appendix B to the FS Report) for soils in and outside of windblown tailings, respectively (FID 8, 18, 20 in tailings). A subset of the data collected using x-ray fluorescence as part of the Railroad Interim Removal Action (Golder 2013) was collected at 0-2 inch" and sieved at <0.25 mm; the same ratios described here were applied to these data to estimate 0 to 6 inch bgs.
[2]Data were collected for ecological endpoint and were not corrected to human health values.
[3]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as IRA.
[4]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as HWY 180.
[5]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as 2:1 slope.
[6]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as Volcanic Rock.
[7]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as NMDOT.
[8]If two samples were collected from the same location in the same sampling year (with identical sample location coordinates), an average was used in place of the two parent samples. For the co-located samples U04-1121 (SRK 2008) and FID 18 (Arcadis 2009), samples were collected in different years, and the sample from the more recent year was used (FID 18).
*Removed samples with the asterisk are set to 327 for the Theissens analysis. All other removed samples are completely voided.
-- means no data available at the location.

TABLE 3-2
STSIU Surface Soil Copper Results Adjusted to 0-6"

STSIU Feasibility Study
Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Location ID	Alternate ID	Source Report	Year Collected	Original Soil depth	Sieving Status	1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]	Northing (State Plane)	Easting (State Plane)	Latitude	Longitude	Copper Concentration[1]: To Compare to HH Pre-FS RAC (250 µm sieve)	Copper Concentration[1]: For Bird Pre-FS RAC Analysis (2000 µm sieve)	Pre-Interim Remedial Action (IRA) Dataset	Removed in Post-IRA Dataset	Reason Removed (also see this column's footnotes)
RR-012		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		619442.081	2637954.089	32.7025700	-108.1101100	176	158	N		
RR-013		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		619441.768	2638074.055	32.7025700	-108.1097200	50	45	N		
RR014		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		618640.416	2630116.828	32.7003080	-108.1355810	1,476	1033	N		
RR-014		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		619441.456	2638194.021	32.7025700	-108.1093300	1235	1112	N		
RR-015		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		619323.594	2637353.944	32.7022400	-108.1120600	123	111	N		
RR-016		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		619323.279	2637473.910	32.7022400	-108.1116700	141	127	N		
RR017		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		617586.703	2630908.729	32.6974180	-108.1329970	544	381	N		
RR018		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		617717.894	2630909.376	32.6977780	-108.1329960	1,135	795	N		
RR019		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		617718.638	2630774.885	32.6977790	-108.1334330	1,407	985	N		
RR-019		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		619322.328	2637836.885	32.7022400	-108.1104900	390	351	N		
RR020		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		617849.828	2630775.533	32.6981400	-108.1334320	1,008	706	N		
RR-020		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		619322.015	2637956.852	32.7022400	-108.1101000	989	890	N		
RR021		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		617849.202	2630906.733	32.6981390	-108.1330060	1,413	989	N		
RR-021		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		619321.702	2638076.818	32.7022400	-108.1097100	61	55	N		
RR022		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		617981.018	2630776.181	32.6985000	-108.1334310	140	98	N		
RR-023		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		619202.898	2637596.638	32.7019100	-108.1112700	303	273	N		
RR024		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		618115.519	2630776.900	32.6988700	-108.1334300	364	255	N		
RR-024		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		619202.584	2637716.605	32.7019100	-108.1108800	1578	1420	N		
RR025		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		618114.857	2630908.098	32.6988690	-108.1330040	387	271	N		
RR026		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		618246.709	2630777.548	32.6992310	-108.1334290	220	154	N		
RR-026		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		619201.957	2637956.538	32.7019100	-108.1101000	1265	1139	N		
RR027		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		618377.678	2630676.497	32.6995900	-108.1337590	237	166	N		
RR-027		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		619201.644	2638076.505	32.7019100	-108.1097100	465	419	N		
RR028		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		618509.269	2630664.012	32.6999510	-108.1338010	311	218	N		
RR029		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		618640.742	2630654.817	32.7003130	-108.1338320	470	329	N		
RR-029		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		619082.525	2637716.291	32.7015800	-108.1108800	23	21	N		
RR030		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		618775.526	2630645.725	32.7006830	-108.1338630	1,101	771	N		
RR-030		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		619082.212	2637836.258	32.7015800	-108.1104900	573	516	N		
RR031		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		618896.976	2630642.808	32.7010170	-108.1338730	272	190	N		
RR-031		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		619081.898	2637956.225	32.7015800	-108.1101000	16	14	N		
RR032		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		618906.090	2630777.568	32.7010430	-108.1334350	1,211	848	N		
RR-032		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		619081.585	2638076.192	32.7015800	-108.1097100	284	256	N		
RR033		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		618112.947	2631081.929	32.6988650	-108.1324390	377	264	N		
RR-033		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		619081.273	2638196.160	32.7015800	-108.1093200	1312	1181	N		
RR034		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		618244.456	2631072.733	32.6992270	-108.1324700	991	694	N		
RR035		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		618379.322	2631060.347	32.6995970	-108.1325110	5,623	3936	N	Removed*	RR Depot
RR-035		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618962.467	2637715.976	32.7012500	-108.1108800	697	627	N		
RR-036		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618962.153	2637835.944	32.7012500	-108.1104900	108	97	N		
RR037		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		618510.452	2631172.536	32.6999590	-108.1321480	1,148	804	N		
RR-037		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618961.840	2637955.912	32.7012500	-108.1101000	851	766	N		
RR038		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		618641.642	2631173.183	32.7003190	-108.1321470	4,338	3037	N		
RR-038		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618961.527	2638075.879	32.7012500	-108.1097100	590	531	N		
RR040		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		618772.951	2631170.538	32.7006800	-108.1321560	1,616	1131	N		
RR041		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		618775.483	2631305.095	32.7006880	-108.1317190	6,041	4229	N	Removed*	RR Depot
RR-041		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618842.409	2637715.662	32.7009200	-108.1108800	484	436	N		
RR042		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		618906.673	2631305.741	32.7010490	-108.1317180	3,290	2303	N		
RR-042		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618842.095	2637835.630	32.7009200	-108.1104900	79	71	N		

Footnotes:
[1]PreFS RAC for copper for small ground feeding bird applies to 0-6" soil sieved to < 2 mm (2000 µm). Pre-FS RAC for human health applies to 0-1" soil sieved to < 0.25 mm (250 µm). The ratio used to convert copper concentration of 0-1" sieved at <0.25 mm soils to 0-6" sieved at < 2 mm soils is from Appendix A (median ratio of SS samples) of Arcadis (2011). Multiplied copper concentration by 0.7 if outside windblown tailings (and by 1.5 if inside windblown tailings). If unsieved, multiplied by 0.9 if outside windblown tailings and by 1.3 if inside windblown tailings. The 0.9 and 1.3 are from median ratios of unsieved 0-1" soil in 2009 lab reports (at 25 m on transect) compared to sieved 0-6" co-located soil in Drexler lab report in Appendix D of the pH Monitoring Report (Appendix B to the FS Report) for soils in and outside of windblown tailings, respectively (FID 8, 18, 20 in tailings). A subset of the data collected using x-ray fluorescence as part of the Railroad Interim Removal Action (Golder 2013) was collected at 0-2 inch" and sieved at <0.25 mm; the same ratios described here were applied to these data to estimate 0 to 6 inch bgs.
[2]Data were collected for ecological endpoint and were not corrected to human health values.
[3]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as IRA.
[4]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as HWY 180.
[5]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as 2:1 slope.
[6]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as Volcanic Rock.
[7]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as NMDOT.
[8]If two samples were collected from the same location in the same sampling year (with identical sample location coordinates), an average was used in place of the two parent samples. For the co-located samples U04-1121 (SRK 2008) and FID 18 (Arcadis 2009), samples were collected in different years, and the sample from the more recent year was used (FID 18).
*Removed samples with the asterisk are set to 327 for the Theissens analysis. All other removed samples are completely voided.
-- means no data available at the location.

TABLE 3-2
STSIU Surface Soil Copper Results Adjusted to 0-6"

STSIU Feasibility Study
Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Location ID	Alternate ID	Source Report	Year Collected	Original Soil depth	Sieving Status	1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]	Northing (State Plane)	Easting (State Plane)	Latitude	Longitude	Copper Concentration[1] To Compare to HH Pre-FS RAC (250 µm sieve)	Copper Concentration[1] For Bird Pre-FS RAC Analysis (2000 µm sieve)	Pre-Interim Remedial Action (IRA) Dataset	Removed in Post-IRA Dataset	Reason Removed (also see this column's footnotes)
RR043		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		618907.416	2631171.255	32.7010500	-108.1321550	2,351	1646	N		
RR-043		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618841.782	2637955.598	32.7009200	-108.1101000	780	702	N		
RR044		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		619036.879	2630791.320	32.7014030	-108.1333920	326	228	N		
RR-044		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618841.469	2638075.567	32.7009200	-108.1097100	660	594	N		
RR-045		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618841.156	2638195.535	32.7009200	-108.1093200	40	36	N		
RR-047		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618722.350	2637715.348	32.7005900	-108.1108800	50	45	N		
RR-048		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618722.037	2637835.317	32.7005900	-108.1104900	271	244	N		
RR-049		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618721.723	2637955.285	32.7005900	-108.1101000	39	35	N		
RR-050		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618721.411	2638075.254	32.7005900	-108.1097100	955	860	N		
RR-051		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618721.098	2638195.222	32.7005900	-108.1093200	761	685	N		
RR-053		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618601.978	2637835.003	32.7002600	-108.1104900	165	149	N		
RR-054		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618601.665	2637954.972	32.7002600	-108.1101000	367	330	N		
RR-055		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618601.352	2638074.941	32.7002600	-108.1097100	54	49	N		
RR-056		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618601.040	2638194.910	32.7002600	-108.1093200	982	884	N		
RR-058		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618481.920	2637834.689	32.6999300	-108.1104900	496	446	N		
RR-059		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618481.607	2637954.659	32.6999300	-108.1101000	842	758	N		
RR-060		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618481.294	2638074.628	32.6999300	-108.1097100	820	738	N		
RR-061		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618480.981	2638194.597	32.6999300	-108.1093200	707	636	N		
RR-063		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618361.862	2637834.375	32.6996000	-108.1104900	597	537	N		
RR-064		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618361.548	2637954.345	32.6996000	-108.1101000	1006	905	N		
RR-065		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618361.236	2638074.315	32.6996000	-108.1097100	1154	1039	N		
RR-066		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618360.923	2638194.285	32.6996000	-108.1093200	1479	1331	N		
RR069		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		619435.606	2631170.652	32.7025020	-108.1321620	301	211	N		
RR-069		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618241.490	2637954.032	32.6992700	-108.1101000	369	332	N		
RR070		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		619566.054	2631305.782	32.7028610	-108.1317240	1,916	1341	N		
RR-070		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618241.177	2638074.002	32.6992700	-108.1097100	585	527	N		
RR071		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		619566.796	2631171.298	32.7028620	-108.1321610	163	114	N		
RR-071		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618240.865	2638193.973	32.6992700	-108.1093200	97	87	N		
RR072		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		619567.421	2631040.106	32.7028630	-108.1325880	189	132	N		
RR-072		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618240.553	2638313.943	32.6992700	-108.1089300	93	84	N		
RR073		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		619698.046	2631280.191	32.7032240	-108.1318090	1,227	859	N		
RR074		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		619697.987	2631171.945	32.7032230	-108.1321600	187	131	N		
RR-074		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618121.424	2637956.795	32.6989400	-108.1100900	363	327	N		
RR075		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		619698.648	2631040.722	32.7032240	-108.1325870	364	255	N		
RR-075		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618121.111	2638076.766	32.6989400	-108.1097000	615	554	N		
RR076		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		619829.177	2631172.560	32.7035830	-108.1321600	278	195	N		
RR-076		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618120.799	2638196.736	32.6989400	-108.1093100	1008	907	N		
RR077		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		619829.838	2631041.369	32.7035840	-108.1325860	311	218	N		
RR-077		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618120.487	2638316.707	32.6989400	-108.1089200	63	57	N		
RR078		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		619960.404	2631173.207	32.7039440	-108.1321590	248	174	N		
RR079		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		619961.147	2631038.725	32.7039450	-108.1325960	290	203	N		
RR-079		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618001.366	2637956.481	32.6986100	-108.1100900	673	606	N		
RR080		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		619961.171	2630927.219	32.7039440	-108.1329580	276	193	N		
RR-080		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618001.053	2638076.453	32.6986100	-108.1097000	473	426	N		
RR081		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		620094.950	2631170.664	32.7043140	-108.1321680	1,321	925	N		
RR-081		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618000.740	2638196.424	32.6986100	-108.1093100	1330	1197	N		
RR082		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		620092.337	2631039.372	32.7043060	-108.1325950	222	155	N		

Footnotes:
[1]PreFS RAC for copper for small ground feeding bird applies to 0-6" soil sieved to < 2 mm (2000 µm). Pre-FS RAC for human health applies to 0-1" soil sieved to < 0.25 mm (250 µm). The ratio used to convert copper concentration of 0-1" sieved at <0.25 mm soils to 0-6" sieved at < 2 mm soils is from Appendix A (median ratio of SS samples) of Arcadis (2011). Multiplied copper concentration by 0.7 if outside windblown tailings (and by 1.5 if inside windblown tailings). If unsieved, multiplied by 0.9 if outside windblown tailings and by 1.3 if inside windblown tailings. The 0.9 and 1.3 are from median ratios of unsieved 0-1" soil in 2009 lab reports (at 25 m on transect) compared to sieved 0-6" co-located soil in Drexler lab report in Appendix D of the pH Monitoring Report (Appendix B to the FS Report) for soils in and outside of windblown tailings, respectively (FID 8, 18, 20 in tailings). A subset of the data collected using x-ray fluorescence as part of the Railroad Interim Removal Action (Golder 2013) was collected at 0-2 inch" and sieved at <0.25 mm; the same ratios described here were applied to these data to estimate 0 to 6 inch bgs.
[2]Data were collected for ecological endpoint and were not corrected to human health values.
[3]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as IRA.
[4]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as HWY 180.
[5]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as 2:1 slope.
[6]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as Volcanic Rock.
[7]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as NMDOT.
[8]If two samples were collected from the same location in the same sampling year (with identical sample location coordinates), an average was used in place of the two parent samples. For the co-located samples U04-1121 (SRK 2008) and FID 18 (Arcadis 2009), samples were collected in different years, and the sample from the more recent year was used (FID 18).
*Removed samples with the asterisk are set to 327 for the Theissens analysis. All other removed samples are completely voided.
-- means no data available at the location.

TABLE 3-2
STSIU Surface Soil Copper Results Adjusted to 0-6"

STSIU Feasibility Study
Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Location ID	Alternate ID	Source Report	Year Collected	Original Soil depth	Sieving Status	1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]	Northing (State Plane)	Easting (State Plane)	Latitude	Longitude	Copper Concentration[1] To Compare to HH Pre-FS RAC (250 µm sieve)	Copper Concentration[1] For Bird Pre-FS RAC Analysis (2000 µm sieve)	Pre-Interim Remedial Action (IRA) Dataset	Removed in Post-IRA Dataset	Reason Removed (also see this column's footnotes)
RR-082		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618000.428	2638316.395	32.6986100	-108.1089200	416	374	N		
RR083		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		620092.762	2630914.733	32.7043060	-108.1330000	721	505	N		
RR084		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		620226.177	2631171.311	32.7046750	-108.1321670	1,074	752	N		
RR-084		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617881.307	2637956.168	32.6982800	-108.1100900	79	71	N		
RR085		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		620226.802	2631040.121	32.7046750	-108.1325940	682	477	N		
RR-085		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617880.994	2638076.140	32.6982800	-108.1097000	1319	1187	N		
RR086		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		620227.463	2630908.931	32.7046760	-108.1330200	579	405	N		
RR-086		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617880.682	2638196.111	32.6982800	-108.1093100	89	80	N		
RR087		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		620357.368	2631171.957	32.7050350	-108.1321660	1,090	763	N		
RR-087		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617880.370	2638316.083	32.6982800	-108.1089200	822	740	N		
RR088		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		620357.992	2631040.768	32.7050360	-108.1325930	399	279	N		
RR089		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		620357.488	2630948.887	32.7050340	-108.1328920	317	222	N		
RR-089		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617760.936	2638075.827	32.6979500	-108.1097000	273	246	N		
RR090		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		620489.219	2631041.384	32.7053970	-108.1325920	310	217	N		
RR-090		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617760.624	2638195.799	32.6979500	-108.1093100	475	428	N		
RR091		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		620489.361	2630926.589	32.7053960	-108.1329650	297	208	N		
RR-091		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617760.312	2638315.771	32.6979500	-108.1089200	427	384	N		
RR092		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		620620.491	2631038.771	32.7057570	-108.1326020	927	649	N		
RR-092		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617763.638	2638435.753	32.6979600	-108.1085300	38	34	N		
RR093		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		620620.670	2630923.946	32.7057570	-108.1329750	456	319	N		
RR094		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		620754.992	2631039.489	32.7061270	-108.1326010	384	269	N		
RR-094		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617640.878	2638075.514	32.6976200	-108.1097000	298	268	N		
RR095		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		620752.344	2630908.200	32.7061190	-108.1330270	312	218	N		
RR-095		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617640.566	2638195.487	32.6976200	-108.1093100	461	415	N		
RR096		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		620886.183	2631040.136	32.7064880	-108.1326000	1,014	710	N		
RR-096		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617640.254	2638315.459	32.6976200	-108.1089200	558	502	N		
RR097		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		620886.808	2630908.949	32.7064880	-108.1330260	168	118	N		
RR-097		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617643.580	2638435.441	32.6976300	-108.1085300	187	168	N		
RR098		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		621017.998	2630909.597	32.7068490	-108.1330250	435	305	N		
RR099		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		621149.307	2630906.953	32.7072100	-108.1330350	223	156	N		
RR-099		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617520.820	2638075.201	32.6972900	-108.1097000	366	329	N		
RR100		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		621280.498	2630907.601	32.7075710	-108.1330340	1,452	1016	N		
RR-100		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617520.507	2638195.174	32.6972900	-108.1093100	720	648	N		
RR101		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		621313.336	2630797.023	32.7076600	-108.1333940	265	186	N		
RR-101		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617520.195	2638315.147	32.6972900	-108.1089200	183	165	N		
RR102		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		621415.224	2630790.237	32.7079400	-108.1334170	366	256	N		
RR-102		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617523.522	2638435.130	32.6973000	-108.1085300	24	22	N		
RR103		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		621546.815	2630777.783	32.7083010	-108.1334590	575	403	N		
RR-103		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617523.211	2638555.103	32.6973000	-108.1081400	527	474	N		
RR104		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		621151.213	2631172.718	32.7072170	-108.1321710	625	438	N		
RR-104		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617400.761	2638074.888	32.6969600	-108.1097000	372	335	N		
RR105		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		621151.473	2631054.634	32.7072170	-108.1325550	253	177	N		
RR-105		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617400.449	2638194.862	32.6969600	-108.1093100	374	337	N		
RR106		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		621283.147	2631038.888	32.7075790	-108.1326080	1,221	855	N		
RR-106		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617400.137	2638314.835	32.6969600	-108.1089200	237	213	N		
RR-107		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617403.464	2638434.818	32.6969700	-108.1085300	514	463	N		
RR-108		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617403.153	2638554.792	32.6969700	-108.1081400	346	311	N		

Footnotes:
[1]PreFS RAC for copper for small ground feeding bird applies to 0-6" soil sieved to < 2 mm (2000 µm). Pre-FS RAC for human health applies to 0-1" soil sieved to < 0.25 mm (250 µm). The ratio used to convert copper concentration of 0-1" sieved at <0.25 mm soils to 0-6" sieved at < 2 mm soils is from Appendix A (median ratio of SS samples) of Arcadis (2011). Multiplied copper concentration by 0.7 if outside windblown tailings (and by 1.5 if inside windblown tailings). If unsieved, multiplied by 0.9 if outside windblown tailings and by 1.3 if inside windblown tailings. The 0.9 and 1.3 are from median ratios of unsieved 0-1" soil in 2009 lab reports (at 25 m on transect) compared to sieved 0-6" co-located soil in Drexler lab report in Appendix D of the pH Monitoring Report (Appendix B to the FS Report) for soils in and outside of windblown tailings, respectively (FID 8, 18, 20 in tailings). A subset of the data collected using x-ray fluorescence as part of the Railroad Interim Removal Action (Golder 2013) was collected at 0-2 inch" and sieved at <0.25 mm; the same ratios described here were applied to these data to estimate 0 to 6 inch bgs.
[2]Data were collected for ecological endpoint and were not corrected to human health values.
[3]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as IRA.
[4]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as HWY 180.
[5]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as 2:1 slope.
[6]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as Volcanic Rock.
[7]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as NMDOT.
[8]If two samples were collected from the same location in the same sampling year (with identical sample location coordinates), an average was used in place of the two parent samples. For the co-located samples U04-1121 (SRK 2008) and FID 18 (Arcadis 2009), samples were collected in different years, and the sample from the more recent year was used (FID 18).
*Removed samples with the asterisk are set to 327 for the Theissens analysis. All other removed samples are completely voided.
-- means no data available at the location.

TABLE 3-2
STSIU Surface Soil Copper Results Adjusted to 0-6”

STSIU Feasibility Study
Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Location ID	Alternate ID	Source Report	Year Collected	Original Soil depth	Sieving Status	1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]	Northing (State Plane)	Easting (State Plane)	Latitude	Longitude	Copper Concentration[1]: To Compare to HH Pre-FS RAC (250 µm sieve)	Copper Concentration[1]: For Bird Pre-FS RAC Analysis (2000 µm sieve)	Pre-Interim Remedial Action (IRA) Dataset	Removed in Post-IRA Dataset	Reason Removed (also see this column's footnotes)
RR-109		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617280.391	2638194.550	32.6966300	-108.1093100	302	272	N		
RR-110		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617283.717	2638314.533	32.6966400	-108.1089200	311	280	N		
RR-111		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617283.406	2638434.507	32.6966400	-108.1085300	538	484	N		
RR-112		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617283.094	2638554.480	32.6966400	-108.1081400	49	44	N		
RR113		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		620491.235	2629985.160	32.7053940	-108.1360260	3,557	2490	N		
RR-113		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617160.333	2638194.237	32.6963000	-108.1093100	222	200	N		
RR114		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		620754.400	2629851.954	32.7061160	-108.1364610	1,804	1263	N		
RR-114		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617163.659	2638314.221	32.6963100	-108.1089200	504	454	N		
RR115		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		620755.030	2629720.766	32.7061170	-108.1368880	2,490	1743	N		
RR-115		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617163.347	2638434.195	32.6963100	-108.1085300	986	887	N		
RR116		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		620886.220	2629721.388	32.7064770	-108.1368870	1,752	1226	N		
RR-116		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617163.036	2638554.169	32.6963100	-108.1081400	36	32	N		
RR117		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		620886.969	2629586.940	32.7064790	-108.1373240	3,156	2209	N		
RR118		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		621281.870	2629874.285	32.7075660	-108.1363940	359	251	N		
RR-118		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617040.274	2638193.925	32.6959700	-108.1093100	219	197	N		
RR119		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		621413.316	2629976.627	32.7079280	-108.1360620	3,410	2387	N		
RR-119		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617043.601	2638313.909	32.6959800	-108.1089200	146	131	N		
RR120		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		621413.745	2629851.993	32.7079290	-108.1364670	2,626	1838	N		
RR-120		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617043.289	2638433.884	32.6959800	-108.1085300	577	519	N		
RR121		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		621544.306	2629983.829	32.7082880	-108.1360400	1,845	1292	N		
RR-121		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617042.978	2638553.858	32.6959800	-108.1081400	277	249	N		
RR122		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		621414.411	2629720.777	32.7079290	-108.1368940	2,263	1584	N		
RR123		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		621415.042	2629589.592	32.7079300	-108.1373210	1,520	1064	N		
RR-123		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616920.208	2638196.689	32.6956400	-108.1093000	375	338	N		
RR124		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		621490.164	2629490.149	32.7081360	-108.1376440	1,845	1292	N		
RR-124		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616923.534	2638316.673	32.6956500	-108.1089100	187	168	N		
RR125		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		621565.221	2630381.385	32.7083490	-108.1347480	973	681	N		
RR-125		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616923.223	2638436.648	32.6956500	-108.1085200	426	383	N		
RR126		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		621590.822	2630513.382	32.7084200	-108.1343190	1,235	865	N		
RR-126		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616922.912	2638556.624	32.6956500	-108.1081300	53	48	N		
RR127		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		621679.095	2630522.583	32.7086630	-108.1342900	314	220	N		
RR128		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		621678.267	2630660.318	32.7086620	-108.1338420	676	473	N		
RR-128		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616800.150	2638196.376	32.6953100	-108.1093000	227	204	N		
RR129		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		621678.124	2630775.140	32.7086620	-108.1334690	1,297	908	N		
RR-129		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616803.476	2638316.361	32.6953200	-108.1089100	460	414	N		
RR130		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		621809.314	2630775.788	32.7090230	-108.1334680	1,927	1349	N		
RR-130		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616803.165	2638436.337	32.6953200	-108.1085200	497	447	N		
RR131		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		621809.658	2630654.416	32.7090230	-108.1338620	191	134	N		
RR-131		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616802.854	2638556.313	32.6953200	-108.1081300	134	121	N		
RR132		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		621810.604	2630513.391	32.7090240	-108.1343210	529	370	N		
RR-132		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616802.543	2638676.288	32.6953200	-108.1077400	539	485	N		
RR133		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		621941.913	2630510.749	32.7093850	-108.1343310	381	267	N		
RR-133		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616683.418	2638316.049	32.6949900	-108.1089100	38	34	N		
RR134		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		621941.168	2630645.223	32.7093840	-108.1338930	117	82	N		
RR-134		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616683.106	2638436.025	32.6949900	-108.1085200	334	301	N		
RR135		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622072.477	2630642.581	32.7097450	-108.1339030	168	118	N		
RR-135		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616682.795	2638556.002	32.6949900	-108.1081300	558	502	N		

Footnotes:
[1]PreFS RAC for copper for small ground feeding bird applies to 0-6" soil sieved to < 2 mm (2000 µm). Pre-FS RAC for human health applies to 0-1" soil sieved to < 0.25 mm (250 µm). The ratio used to convert copper concentration of 0-1" sieved at <0.25 mm soils to 0-6" sieved at < 2 mm soils is from Appendix A (median ratio of SS samples) of Arcadis (2011). Multiplied copper concentration by 0.7 if outside windblown tailings (and by 1.5 if inside windblown tailings). If unsieved, multiplied by 0.9 if outside windblown tailings and by 1.3 if inside windblown tailings. The 0.9 and 1.3 are from median ratios of unsieved 0-1" soil in 2009 lab reports (at 25 m on transect) compared to sieved 0-6" co-located soil in Drexler lab report in Appendix D of the pH Monitoring Report (Appendix B to the FS Report) for soils in and outside of windblown tailings, respectively (FID 8, 18, 20 in tailings). A subset of the data collected using x-ray fluorescence as part of the Railroad Interim Removal Action (Golder 2013) was collected at 0-2 inch" and sieved at <0.25 mm; the same ratios described here were applied to these data to estimate 0 to 6 inch bgs.
[2]Data were collected for ecological endpoint and were not corrected to human health values.
[3]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as IRA.
[4]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as HWY 180.
[5]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as 2:1 slope.
[6]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as Volcanic Rock.
[7]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as NMDOT.
[8]If two samples were collected from the same location in the same sampling year (with identical sample location coordinates), an average was used in place of the two parent samples. For the co-located samples U04-1121 (SRK 2008) and FID 18 (Arcadis 2009), samples were collected in different years, and the sample from the more recent year was used (FID 18).
*Removed samples with the asterisk are set to 327 for the Theissens analysis. All other removed samples are completely voided.
-- means no data available at the location.

TABLE 3-2
STSIU Surface Soil Copper Results Adjusted to 0-6"

STSIU Feasibility Study
Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Location ID	Alternate ID	Source Report	Year Collected	Original Soil depth	Sieving Status	1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]	Northing (State Plane)	Easting (State Plane)	Latitude	Longitude	Copper Concentration[1] To Compare to HH Pre-FS RAC (250 µm sieve)	Copper Concentration[1] For Bird Pre-FS RAC Analysis (2000 µm sieve)	Pre-Interim Remedial Action (IRA) Dataset	Removed in Post-IRA Dataset	Reason Removed (also see this column's footnotes)
RR136		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622073.505	2630498.266	32.7097470	-108.1343720	343	240	N		
RR-136		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616682.485	2638675.978	32.6949900	-108.1077400	479	431	N		
RR137		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622205.297	2630479.262	32.7101090	-108.1344350	542	379	N		
RR-137		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616563.360	2638315.738	32.6946600	-108.1089100	313	282	N		
RR138		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622206.941	2630643.331	32.7101150	-108.1339020	375	263	N		
RR-138		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616563.048	2638435.714	32.6946600	-108.1085200	478	430	N		
RR139		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622111.139	2630774.951	32.7098530	-108.1334730	555	389	N		
RR-139		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616562.737	2638555.690	32.6946600	-108.1081300	25	23	N		
RR140		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622206.197	2630777.804	32.7101140	-108.1334650	249	174	N		
RR-140		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616562.427	2638675.667	32.6946600	-108.1077400	178	160	N		
RR141		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622337.506	2630775.161	32.7104750	-108.1334750	1,646	1152	N		
RR142		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622339.556	2630706.330	32.7104800	-108.1336980	1,084	759	N		
RR-142		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616442.990	2638435.403	32.6943300	-108.1085200	407	366	N		
RR143		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622337.465	2631434.521	32.7104800	-108.1313310	2,378	1665	N		
RR-143		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616442.679	2638555.379	32.6943300	-108.1081300	83	75	N		
RR144		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622468.655	2631435.167	32.7108400	-108.1313300	1,611	1128	N		
RR-144		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616442.368	2638675.356	32.6943300	-108.1077400	207	186	N		
RR145		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622471.188	2631569.740	32.7108480	-108.1308930	2,959	2071	N		
RR146		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622602.497	2631567.094	32.7112090	-108.1309020	2,890	2023	N		
RR147		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622603.156	2631435.914	32.7112100	-108.1313290	2,066	1446	N		
RR-147		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616322.932	2638435.091	32.6940000	-108.1085200	661	595	N		
RR148		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622734.347	2631436.559	32.7115710	-108.1313280	2,913	2039	N		
RR-148		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616322.621	2638555.068	32.6940000	-108.1081300	292	263	N		
RR149		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622733.687	2631567.739	32.7115700	-108.1309010	4,883	3418	N		
RR-149		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616322.310	2638675.046	32.6940000	-108.1077400	74	67	N		
RR150		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622733.065	2631698.950	32.7115690	-108.1304750	2,493	1745	N		
RR151		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622864.914	2631568.384	32.7119310	-108.1309000	2,904	2033	N		
RR152		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622865.537	2631437.205	32.7119310	-108.1313270	2,770	1939	N		
RR-152		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616202.252	2638674.735	32.6936700	-108.1077400	228	205	N		
RR153		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622866.480	2631296.154	32.7119330	-108.1317860	990	693	N		
RR154		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622997.470	2631303.350	32.7122930	-108.1317630	840	588	N		
RR155		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622996.846	2631434.560	32.7122920	-108.1313370	3,272	2290	N		
RR156		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622999.379	2631569.131	32.7123000	-108.1308990	3,496	2447	N		
RR-156		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618363.435	2637234.526	32.6996000	-108.1124400	125	113	N	Removed*	Borrow Area
RR157		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		623128.661	2631303.997	32.7126540	-108.1317620	1,860	1302	N		
RR-157		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618363.119	2637354.496	32.6996000	-108.1120500	181	163	N	Removed*	Borrow Area
RR158		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622469.084	2633944.705	32.7108610	-108.1231710	3,306	2314	N		
RR-158		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618240.371	2636994.260	32.6992600	-108.1132200	130	117	N	Removed*	Borrow Area
RR-159		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618243.692	2637114.240	32.6992700	-108.1128300	123	111	N	Removed*	Borrow Area
RR-160		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618243.377	2637234.210	32.6992700	-108.1124400	151	136	N	Removed*	Borrow Area
RR-161		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618243.061	2637354.180	32.6992700	-108.1120500	172	155	N	Removed*	Borrow Area
RR-162		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618242.746	2637474.151	32.6992700	-108.1116600	958	862	N	Removed*	Borrow Area
RR-163		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618120.947	2636754.001	32.6989300	-108.1140000	197	177	N	Removed*	Borrow Area
RR-164		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618120.312	2636993.943	32.6989300	-108.1132200	621	559	N	Removed*	Borrow Area
RR165		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622864.704	2634209.133	32.7119500	-108.1223150	916	641	N		
RR-165		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618123.634	2637113.923	32.6989400	-108.1128300	989	890	N	Removed*	Borrow Area
RR166		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		618774.859	2631436.291	32.7006880	-108.1312930	2,872	2010	N		

Footnotes:
[1]PreFS RAC for copper for small ground feeding bird applies to 0-6" soil sieved to < 2 mm (2000 µm). Pre-FS RAC for human health applies to 0-1" soil sieved to < 0.25 mm (250 µm). The ratio used to convert copper concentration of 0-1" sieved at <0.25 mm soils to 0-6" sieved at < 2 mm soils is from Appendix A (median ratio of SS samples) of Arcadis (2011). Multiplied copper concentration by 0.7 if outside windblown tailings (and by 1.5 if inside windblown tailings). If unsieved, multiplied by 0.9 if outside windblown tailings and by 1.3 if inside windblown tailings. The 0.9 and 1.3 are from median ratios of unsieved 0-1" soil in 2009 lab reports (at 25 m on transect) compared to sieved 0-6" co-located soil in Drexler lab report in Appendix D of the pH Monitoring Report (Appendix B to the FS Report) for soils in and outside of windblown tailings, respectively (FID 8, 18, 20 in tailings). A subset of the data collected using x-ray fluorescence as part of the Railroad Interim Removal Action (Golder 2013) was collected at 0-2 inch" and sieved at <0.25 mm; the same ratios described here were applied to these data to estimate 0 to 6 inch bgs.
[2]Data were collected for ecological endpoint and were not corrected to human health values.
[3]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as IRA.
[4]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as HWY 180.
[5]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as 2:1 slope.
[6]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as Volcanic Rock.
[7]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as NMDOT.
[8]If two samples were collected from the same location in the same sampling year (with identical sample location coordinates), an average was used in place of the two parent samples. For the co-located samples U04-1121 (SRK 2008) and FID 18 (Arcadis 2009), samples were collected in different years, and the sample from the more recent year was used (FID 18).
*Removed samples with the asterisk are set to 327 for the Theissens analysis. All other removed samples are completely voided.
-- means no data available at the location.

TABLE 3-2
STSIU Surface Soil Copper Results Adjusted to 0-6"

STSIU Feasibility Study
Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Location ID	Alternate ID	Source Report	Year Collected	Original Soil depth	Sieving Status	1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]	Northing (State Plane)	Easting (State Plane)	Latitude	Longitude	Copper Concentration[1] To Compare to HH Pre-FS RAC (250 µm sieve)	For Bird Pre-FS RAC Analysis (2000 µm sieve)	Pre-Interim Remedial Action (IRA) Dataset	Removed in Post-IRA Dataset	Reason Removed (also see this column's footnotes)
RR-166		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618123.318	2637233.894	32.6989400	-108.1124400	645	581	N	Removed*	Borrow Area
RR167		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		618774.200	2631567.517	32.7006870	-108.1308660	1,620	1134	N		
RR-167		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618123.003	2637353.865	32.6989400	-108.1120500	601	541	N	Removed*	Borrow Area
RR168		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		618793.222	2631699.291	32.7007400	-108.1304380	1,046	732	N		
RR-168		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618122.688	2637473.836	32.6989400	-108.1116600	559	503	N	Removed*	Borrow Area
RR169		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		618805.696	2631830.892	32.7007750	-108.1300100	1,893	1325	N		
RR-169		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618000.880	2636756.760	32.6986000	-108.1139900	361	325	N	Removed*	Borrow Area
RR170		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		618801.682	2631965.247	32.7007650	-108.1295730	2,657	1860	N		
RR-170		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618000.246	2636996.702	32.6986000	-108.1132100	708	637	N	Removed*	Borrow Area
RR171		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		618904.768	2631699.357	32.7010470	-108.1304390	3,061	2143	N		
RR-171		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618003.568	2637116.683	32.6986100	-108.1128200	331	298	N	Removed*	Borrow Area
RR172		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		618905.427	2631568.132	32.7010470	-108.1308650	2,125	1488	N		
RR-172		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618003.252	2637236.654	32.6986100	-108.1124300	909	818	N	Removed*	Borrow Area
RR173		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		618905.449	2631456.622	32.7010470	-108.1312280	2,573	1801	N		
RR-173		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618002.936	2637356.625	32.6986100	-108.1120400	480	432	N	Removed*	Borrow Area
RR174		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		618337.546	2631141.102	32.6994830	-108.1322480	1,277	894	N		
RR-174		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618002.621	2637476.597	32.6986100	-108.1116500	200	180	N	Removed*	Borrow Area
RR175		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		618535.315	2631219.210	32.7000270	-108.1319960	1,196	837	N		
RR-175		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617881.140	2636636.470	32.6982700	-108.1143800	255	230	N	Removed*	Borrow Area
RR176		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		618758.712	2631317.722	32.7006420	-108.1316780	1,826	1278	N		
RR-176		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617880.822	2636756.442	32.6982700	-108.1139900	1889	1700	N	Removed*	Borrow Area
RR-177		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617880.188	2636996.385	32.6982700	-108.1132100	221	199	N	Removed*	Borrow Area
RR-178		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617883.510	2637116.367	32.6982800	-108.1128200	427	384	N	Removed*	Borrow Area
RR-179		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617883.194	2637236.338	32.6982800	-108.1124300	245	221	N	Removed*	Borrow Area
RR-180		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617882.878	2637356.310	32.6982800	-108.1120400	216	194	N	Removed*	Borrow Area
RR-181		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617882.563	2637476.282	32.6982800	-108.1116500	247	222	N	Removed*	Borrow Area
RR-182		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617761.081	2636636.152	32.6979400	-108.1143800	261	235	N	Removed*	Borrow Area
RR-183		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617760.764	2636756.124	32.6979400	-108.1139900	199	179	N	Removed*	Borrow Area
RR-184		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617763.451	2637116.050	32.6979500	-108.1128200	204	184	N	Removed*	Borrow Area
RR-185		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617763.135	2637236.022	32.6979500	-108.1124300	402	362	N	Removed*	Borrow Area
RR-186		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617762.820	2637355.994	32.6979500	-108.1120400	265	239	N	Removed*	Borrow Area
RR-187		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617762.505	2637475.967	32.6979500	-108.1116500	223	201	N	Removed*	Borrow Area
RR-188		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617641.660	2636395.889	32.6976100	-108.1151600	278	250	N	Removed*	Borrow Area
RR-189		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617641.341	2636515.862	32.6976100	-108.1147700	136	122	N	Removed*	Borrow Area
RR-190		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617641.023	2636635.834	32.6976100	-108.1143800	191	172	N	Removed*	Borrow Area
RR-191		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617640.705	2636755.807	32.6976100	-108.1139900	165	149	N	Removed*	Borrow Area
RR-192		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617642.447	2637475.652	32.6976200	-108.1116500	186	167	N	Removed*	Borrow Area
RR-193		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617521.283	2636515.543	32.6972800	-108.1147700	179	161	N	Removed*	Borrow Area
RR-194		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617520.965	2636635.516	32.6972800	-108.1143800	158	142	N	Removed*	Borrow Area
RR-195		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617520.647	2636755.489	32.6972800	-108.1139900	200	180	N	Removed*	Borrow Area
RR-196		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617522.388	2637475.336	32.6972900	-108.1116500	190	171	N	Removed*	Borrow Area
RR-197		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617401.225	2636515.224	32.6969500	-108.1147700	311	280	N	Removed*	Borrow Area
RR-198		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617400.906	2636635.198	32.6969500	-108.1143800	366	329	N	Removed*	Borrow Area
RR-199		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617400.589	2636755.171	32.6969500	-108.1139900	170	153	N	Removed*	Borrow Area
RR-200		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617402.015	2637594.995	32.6969600	-108.1112600	667	600	N	Removed*	Borrow Area
RR-201		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617281.166	2636514.906	32.6966200	-108.1147700	401	361	N	Removed*	Borrow Area
RR-202		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617280.848	2636634.880	32.6966200	-108.1143800	116	104	N	Removed*	Borrow Area

Footnotes:
[1]PreFS RAC for copper for small ground feeding bird applies to 0-6" soil sieved to < 2 mm (2000 µm). Pre-FS RAC for human health applies to 0-1" soil sieved to < 0.25 mm (250 µm). The ratio used to convert copper concentration of 0-1" sieved at <0.25 mm soils to 0-6" sieved at < 2 mm soils is from Appendix A (median ratio of SS samples) of Arcadis (2011). Multiplied copper concentration by 0.7 if outside windblown tailings (and by 1.5 if inside windblown tailings). If unsieved, multiplied by 0.9 if outside windblown tailings and by 1.3 if inside windblown tailings. The 0.9 and 1.3 are from median ratios of unsieved 0-1" soil in 2009 lab reports (at 25 m on transect) compared to sieved 0-6" co-located soil in Drexler lab report in Appendix D of the pH Monitoring Report (Appendix B to the FS Report) for soils in and outside of windblown tailings, respectively (FID 8, 18, 20 in tailings). A subset of the data collected using x-ray fluorescence as part of the Railroad Interim Removal Action (Golder 2013) was collected at 0-2 inch" and sieved at <0.25 mm; the same ratios described here were applied to these data to estimate 0 to 6 inch bgs.
[2]Data were collected for ecological endpoint and were not corrected to human health values.
[3]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as IRA.
[4]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as HWY 180.
[5]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as 2:1 slope.
[6]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as Volcanic Rock.
[7]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as NMDOT.
[8]If two samples were collected from the same location in the same sampling year (with identical sample location coordinates), an average was used in place of the two parent samples. For the co-located samples U04-1121 (SRK 2008) and FID 18 (Arcadis 2009), samples were collected in different years, and the sample from the more recent year was used (FID 18).
*Removed samples with the asterisk are set to 327 for the Theissens analysis. All other removed samples are completely voided.
-- means no data available at the location.

TABLE 3-2
STSIU Surface Soil Copper Results Adjusted to 0-6"

STSIU Feasibility Study
Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Location ID	Alternate ID	Source Report	Year Collected	Original Soil depth	Sieving Status	1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]	Northing (State Plane)	Easting (State Plane)	Latitude	Longitude	Copper Concentration[1] To Compare to HH Pre-FS RAC (250 µm sieve)	Copper Concentration[1] For Bird Pre-FS RAC Analysis (2000 µm sieve)	Pre-Interim Remedial Action (IRA) Dataset	Removed in Post-IRA Dataset	Reason Removed (also see this column's footnotes)
RR-203		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617280.530	2636754.854	32.6966200	-108.1139900	273	246	N	Removed*	Borrow Area
RR-204		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617281.957	2637594.680	32.6966300	-108.1112600	83	75	N	Removed*	Borrow Area
RR-205		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617161.108	2636514.587	32.6962900	-108.1147700	108	97	N	Removed*	Borrow Area
RR-206		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617160.790	2636634.562	32.6962900	-108.1143800	176	158	N	Removed*	Borrow Area
RR-207		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617160.472	2636754.536	32.6962900	-108.1139900	244	220	N	Removed*	Borrow Area
RR-208		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617161.899	2637594.366	32.6963000	-108.1112600	333	300	N	Removed*	Borrow Area
RR-209		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617040.732	2636634.243	32.6959600	-108.1143800	600	540	N	Removed*	Borrow Area
RR-210		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617040.414	2636754.218	32.6959600	-108.1139900	121	109	N	Removed*	Borrow Area
RR-211		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616920.673	2636633.925	32.6956300	-108.1143800	1063	957	N	Removed*	Borrow Area
RR-212		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616920.356	2636753.901	32.6956300	-108.1139900	544	490	N	Removed*	Borrow Area
RR-213		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616800.607	2636636.684	32.6953000	-108.1143700	2371	2134	N	Removed*	Borrow Area
RR-214		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616800.289	2636756.659	32.6953000	-108.1139800	511	460	N	Removed*	Borrow Area
RR-215		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616680.231	2636756.341	32.6949700	-108.1139800	163	147	N	Removed*	Borrow Area
RR-216		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616683.552	2636876.327	32.6949800	-108.1135900	85	77	N	Removed*	Borrow Area
RR-217		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616560.173	2636756.024	32.6946400	-108.1139800	323	291	N	Removed*	Borrow Area
RR-218		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616563.494	2636876.010	32.6946500	-108.1135900	63	57	N	Removed*	Borrow Area
RR-219		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616561.286	2637715.846	32.6946500	-108.1108600	149	134	N	Removed*	Borrow Area
RR-220		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616440.115	2636755.706	32.6943100	-108.1139800	168	151	N	Removed*	Borrow Area
RR-221		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616443.436	2636875.693	32.6943200	-108.1135900	158	142	N	Removed*	Borrow Area
RR-222		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616323.695	2636755.398	32.6939900	-108.1139800	158	142	N	Removed*	Borrow Area
RR-223		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616323.377	2636875.376	32.6939900	-108.1135900	939	845	N	Removed*	Borrow Area
RR-224		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616203.319	2636875.058	32.6936600	-108.1135900	221	199	N	Removed*	Borrow Area
RR-225		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616203.002	2636995.036	32.6936600	-108.1132000	98	88	N	Removed*	Borrow Area
RR-226		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616083.261	2636874.741	32.6933300	-108.1135900	257	231	N	Removed*	Borrow Area
RR-227		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616082.944	2636994.719	32.6933300	-108.1132000	221	199	N	Removed*	Borrow Area
RR-228		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		615963.203	2636874.424	32.6930000	-108.1135900	174	157	N	Removed*	Borrow Area
RR-229		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		615962.886	2636994.403	32.6930000	-108.1132000	409	368	N	Removed*	Borrow Area
RR-230		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		615960.681	2637834.254	32.6930000	-108.1104700	357	321	N	Removed*	Borrow Area
RR-231		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		615842.828	2636994.086	32.6926700	-108.1132000	126	113	N	Removed*	Borrow Area
RR-232		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		615842.512	2637114.065	32.6926700	-108.1128100	135	122	N	Removed*	Borrow Area
RR-233		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		615840.623	2637833.940	32.6926700	-108.1104700	64	58	N	Removed*	Borrow Area
RR-234		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		615722.762	2636996.846	32.6923400	-108.1131900	237	213	N	Removed*	Borrow Area
RR-235		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		615722.445	2637116.825	32.6923400	-108.1128000	119	107	N	Removed*	Borrow Area
RR-236		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		615720.870	2637716.723	32.6923400	-108.1108500	74	67	N	Removed*	Borrow Area
RR-237		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		615720.557	2637836.703	32.6923400	-108.1104600	48	43	N	Removed*	Borrow Area
RR-238		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		615602.703	2636996.529	32.6920100	-108.1131900	177	159	N	Removed*	Borrow Area
RR-239		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		615602.387	2637116.509	32.6920100	-108.1128000	161	145	N	Removed*	Borrow Area
RR-240		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		615602.071	2637236.489	32.6920100	-108.1124100	130	117	N	Removed*	Borrow Area
RR-241		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		615600.812	2637716.409	32.6920100	-108.1108500	76	68	N	Removed*	Borrow Area
RR-242		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		615600.499	2637836.389	32.6920100	-108.1104600	126	113	N	Removed*	Borrow Area
RR-243		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618782.339	2637038.756	32.7007500	-108.1130800	176	158	N	Removed*	Borrow Area
RR-244		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618596.275	2637235.139	32.7002400	-108.1124400	169	152	N	Removed*	Borrow Area
RR-245		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		618553.315	2636970.476	32.7001200	-108.1133000	139	125	N	Removed*	Borrow Area
RR-246		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		617232.090	2637188.481	32.6964900	-108.1125800	252	227	N	Removed*	Borrow Area
RR-247		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616537.653	2637017.454	32.6945800	-108.1131300	96	86	N	Removed*	Borrow Area
RR-248		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		616063.927	2637308.461	32.6932800	-108.1121800	63	57	N	Removed*	Borrow Area
RR-249		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		615386.775	2637482.039	32.6914200	-108.1116100	83	75	N	Removed*	Borrow Area

Footnotes:
[1]PreFS RAC for copper for small ground feeding bird applies to 0-6" soil sieved to < 2 mm (2000 µm). Pre-FS RAC for human health applies to 0-1" soil sieved to < 0.25 mm (250 µm). The ratio used to convert copper concentration of 0-1" sieved at <0.25 mm soils to 0-6" sieved at < 2 mm soils is from Appendix A (median ratio of SS samples) of Arcadis (2011). Multiplied copper concentration by 0.7 if outside windblown tailings (and by 1.5 if inside windblown tailings). If unsieved, multiplied by 0.9 if outside windblown tailings and by 1.3 if inside windblown tailings. The 0.9 and 1.3 are from median ratios of unsieved 0-1" soil in 2009 lab reports (at 25 m on transect) compared to sieved 0-6" co-located soil in Drexler lab report in Appendix D of the pH Monitoring Report (Appendix B to the FS Report) for soils in and outside of windblown tailings, respectively (FID 8, 18, 20 in tailings). A subset of the data collected using x-ray fluorescence as part of the Railroad Interim Removal Action (Golder 2013) was collected at 0-2 inch" and sieved at <0.25 mm; the same ratios described here were applied to these data to estimate 0 to 6 inch bgs.
[2]Data were collected for ecological endpoint and were not corrected to human health values.
[3]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as IRA.
[4]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as HWY 180.
[5]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as 2:1 slope.
[6]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as Volcanic Rock.
[7]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as NMDOT.
[8]If two samples were collected from the same location in the same sampling year (with identical sample location coordinates), an average was used in place of the two parent samples. For the co-located samples U04-1121 (SRK 2008) and FID 18 (Arcadis 2009), samples were collected in different years, and the sample from the more recent year was used (FID 18).
*Removed samples with the asterisk are set to 327 for the Theissens analysis. All other removed samples are completely voided.
-- means no data available at the location.

TABLE 3-2
STSIU Surface Soil Copper Results Adjusted to 0-6"

STSIU Feasibility Study
Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Location ID	Alternate ID	Source Report	Year Collected	Original Soil depth	Sieving Status	1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]	Northing (State Plane)	Easting (State Plane)	Latitude	Longitude	Copper Concentration[1] To Compare to HH Pre-FS RAC (250 µm sieve)	Copper Concentration[1] For Bird Pre-FS RAC Analysis (2000 µm sieve)	Pre-Interim Remedial Action (IRA) Dataset	Removed in Post-IRA Dataset	Reason Removed (also see this column's footnotes)
RR250		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		616792.859	2630907.963	32.6952360	-108.1329920	1,791	1254	N		
RR-250		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		615358.317	2637235.848	32.6913400	-108.1124100	98	88	N	Removed*	Borrow Area
RR251		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		616927.323	2630908.712	32.6956050	-108.1329910	905	634	N		
RR-251		Razorback Ridge Interim Removal Action, Golder 2015	2014	0-1"	2 mm sieve		619099.400	2636833.493	32.7016200	-108.1137500	457	411	N	Removed*	Borrow Area
RR252		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		616924.675	2630777.407	32.6955970	-108.1334170	1,729	1210	N		
RR253		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		616925.419	2630642.943	32.6955980	-108.1338550	1,481	1037	N		
RR254		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		616905.096	2630445.509	32.6955400	-108.1344960	1,675	1173	N		
RR255		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		617059.054	2631001.219	32.6959680	-108.1326910	644	451	N		
RR256		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		617058.111	2631142.265	32.6959660	-108.1322330	2,489	1742	N		
RR257		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		617189.820	2631126.516	32.6963280	-108.1322850	3,992	2794	N		
RR257 (mean)		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		617189.820	2631126.516	32.6963280	-108.1322850	3,608	2526	N		
RR257-Ea		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		617189.538	2631136.329	32.6963280	-108.1322530	3,340	2338	N	Removed	Used mean of 4 co-located samples (Ea, Nb, Sc and
RR257-Nb		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		617199.642	2631126.790	32.6963550	-108.1322840	5,442	3809	N	Removed	Used mean of 4 co-located samples (Ea, Nb, Sc and
RR257-Sc		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		617179.998	2631126.212	32.6963010	-108.1322860	1,839	1287	N	Removed	Used mean of 4 co-located samples (Ea, Nb, Sc and
RR257-Wd		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		617190.103	2631116.673	32.6963290	-108.1323170	3,813	2669	N	Removed	Used mean of 4 co-located samples (Ea, Nb, Sc and
RR258		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		617190.645	2630988.762	32.6963300	-108.1327330	2,447	1713	N		
RR259		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		617322.355	2630973.014	32.6966920	-108.1327850	1,474	1032	N		
RR260		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		617321.293	2631117.320	32.6966900	-108.1323160	1,206	844	N		
RR261		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		617507.934	2630909.644	32.6972010	-108.1329930	1,074	752	N		
RR262		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		617587.329	2630777.528	32.6974180	-108.1334230	2,315	1621	N		
RR264		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622338.476	2630522.610	32.7104760	-108.1342960	441	309	N		
RR265		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622471.229	2630690.586	32.7108420	-108.1337510	661	463	N		
RR266		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622469.986	2630513.417	32.7108370	-108.1343270	2,092	1464	N		
RR267		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622339.423	2630381.556	32.7104770	-108.1347540	963	674	N		
RR268		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622468.696	2630775.809	32.7108350	-108.1334740	3,035	2125	N		
RR269		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622602.538	2630687.944	32.7112030	-108.1337610	1,067	747	N		
RR270		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		619298.833	2631356.831	32.7021270	-108.1315560	856	599	N		
RR271		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		619430.706	2631334.531	32.7024890	-108.1316290	968	678	N		
RR272		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		619826.845	2631251.239	32.7035780	-108.1319040	1,721	1205	N		
RR273		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		619958.719	2631228.940	32.7039400	-108.1319780	941	659	N		
RR274		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		620090.711	2631203.350	32.7043020	-108.1320620	1,450	1015	N		
RR275		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		620222.384	2631187.603	32.7046640	-108.1321140	1,232	862	N		
RR276		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		620486.368	2631136.455	32.7053900	-108.1322830	501	351	N		
RR277		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		620618.642	2631101.024	32.7057530	-108.1323990	2,089	1462	N		
RR278		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		620750.835	2631068.914	32.7061160	-108.1325050	369	258	N		
RR279		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		621012.192	2630994.691	32.7068340	-108.1327490	610	427	N		
RR280		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		621151.215	2630952.944	32.7072150	-108.1328860	369	258	N		
RR281		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622603.161	2630776.528	32.7112050	-108.1334730	2,637	1846	N		
RR282		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622733.729	2630688.593	32.7115630	-108.1337600	441	309	N		
RR283		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622601.258	2630510.776	32.7111980	-108.1343370	2,135	1495	N		
RR284		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622470.732	2630378.915	32.7108380	-108.1347640	1,278	895	N		
RR285		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622336.895	2630246.982	32.7104690	-108.1351920	390	273	N		
RR286		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		621408.615	2630901.565	32.7079230	-108.1330550	1,127	789	N		
RR287		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		621541.290	2630853.065	32.7082870	-108.1332140	682	477	N		
RR288		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		621673.565	2630817.636	32.7086500	-108.1333300	1,248	874	N		
RR289		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		621938.115	2630746.809	32.7093770	-108.1335630	889	622	N		
RR290		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622073.782	2630708.223	32.7097490	-108.1336900	1,249	874	N		

Footnotes:
[1]PreFS RAC for copper for small ground feeding bird applies to 0-6" soil sieved to < 2 mm (2000 µm). Pre-FS RAC for human health applies to 0-1" soil sieved to < 0.25 mm (250 µm). The ratio used to convert copper concentration of 0-1" sieved at <0.25 mm soils to 0-6" sieved at < 2 mm soils is from Appendix A (median ratio of SS samples) of Arcadis (2011). Multiplied copper concentration by 0.7 if outside windblown tailings (and by 1.5 if inside windblown tailings). If unsieved, multiplied by 0.9 if outside windblown tailings and by 1.3 if inside windblown tailings. The 0.9 and 1.3 are from median ratios of unsieved 0-1" soil in 2009 lab reports (at 25 m on transect) compared to sieved 0-6" co-located soil in Drexler lab report in Appendix D of the pH Monitoring Report (Appendix B to the FS Report) for soils in and outside of windblown tailings, respectively (FID 8, 18, 20 in tailings). A subset of the data collected using x-ray fluorescence as part of the Railroad Interim Removal Action (Golder 2013) was collected at 0-2 inch" and sieved at <0.25 mm; the same ratios described here were applied to these data to estimate 0 to 6 inch bgs.
[2]Data were collected for ecological endpoint and were not corrected to human health values.
[3]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as IRA.
[4]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as HWY 180.
[5]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as 2:1 slope.
[6]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as Volcanic Rock.
[7]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as NMDOT.
[8]If two samples were collected from the same location in the same sampling year (with identical sample location coordinates), an average was used in place of the two parent samples. For the co-located samples U04-1121 (SRK 2008) and FID 18 (Arcadis 2009), samples were collected in different years, and the sample from the more recent year was used (FID 18).
*Removed samples with the asterisk are set to 327 for the Theissens analysis. All other removed samples are completely voided.
-- means no data available at the location.

TABLE 3-2
STSIU Surface Soil Copper Results Adjusted to 0-6"

STSIU Feasibility Study
Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Location ID	Alternate ID	Source Report	Year Collected	Original Soil depth	Sieving Status	1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]	Northing (State Plane)	Easting (State Plane)	Latitude	Longitude	Copper Concentration[1]: To Compare to HH Pre-FS RAC (250 µm sieve)	Copper Concentration[1]: For Bird Pre-FS RAC Analysis (2000 µm sieve)	Pre-Interim Remedial Action (IRA) Dataset	Removed in Post-IRA Dataset	Reason Removed (also see this column's footnotes)
RR291		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622199.509	2630672.623	32.7100950	-108.1338070	711	498	N		
RR292		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622332.067	2630627.384	32.7104590	-108.1339550	384	269	N		
RR293		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622470.124	2630618.394	32.7108380	-108.1339850	772	540	N		
RR294		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622608.264	2630606.114	32.7112180	-108.1340270	991	694	N		
RR295		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		621943.096	2630799.451	32.7093910	-108.1333920	518	363	N		
RR296		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		621810.739	2630838.140	32.7090270	-108.1332650	259	181	N		
RR297		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		621677.380	2630909.615	32.7086610	-108.1330310	969	678	N		
RR298		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		621653.800	2631040.119	32.7085980	-108.1326070	420	294	N		
RR299		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		621545.388	2630935.202	32.7082990	-108.1329470	734	514	N		
RR300		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		621412.430	2630993.545	32.7079340	-108.1327560	564	395	N		
RR301		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622734.351	2630777.177	32.7115660	-108.1334720	384	269	N		
RR302		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622868.194	2630689.343	32.7119330	-108.1337580	1,432	1002	N		
RR303		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622735.096	2630642.706	32.7115670	-108.1339090	1,934	1354	N	Removed	Co-located samples[8]
RR304		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622735.096	2630642.706	32.7115670	-108.1339090	262	183	N	Removed	Co-located samples[8]
RR305		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622865.660	2630774.534	32.7119260	-108.1334820	2,921	2045	N		
RR306		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622602.535	2630907.739	32.7112040	-108.1330460	979	685	N		
RR307		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622733.100	2631039.567	32.7115640	-108.1326190	1,149	804	N		
RR308		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622864.916	2630909.035	32.7119250	-108.1330440	2,868	2008	N		
RR309		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622400.829	2631400.343	32.7106540	-108.1314430	379	265	N		
RR310		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622398.461	2631478.984	32.7106480	-108.1311870	505	354	N		
RR311		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622385.989	2631567.194	32.7106140	-108.1309000	563	394	N		
RR312		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622426.740	2631630.731	32.7107270	-108.1306940	337	236	N		
RR313		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622521.279	2631649.974	32.7109870	-108.1306320	785	550	N		
RR314		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622545.800	2631598.216	32.7110540	-108.1308010	432	302	N		
RR315		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622587.315	2631635.549	32.7111680	-108.1306800	523	366	N		
RR316		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622075.489	2630760.763	32.7097550	-108.1335190	147	103	N		
RR317		Railroad Interim Removal Action, Golder 2013	2012	0-2"	0.25 mm sieve		622204.490	2630725.264	32.7101090	-108.1336360	117	82	N		
STS-BWC-2011-7		FS Data Collection, submitted herein	2011	0-6"	2 mm sieve (a)		620325.258	2638297.829	32.7049931	-108.1093354	--	--	N		
STS-BWC-2011-8		FS Data Collection, submitted herein	2011	0-6"	2 mm sieve (a)		619230.643	2639525.419	32.7017480	-108.1048729	--	--	N		
STS-BWC-2011-9		FS Data Collection, submitted herein	2011	0-6"	2 mm sieve (a)		622504.963	2639533.807	32.7112890	-108.1051704	--	--	N		
STS-BWC-2011-10		FS Data Collection, submitted herein	2011	0-6"	2 mm sieve (a)		619599.237	2637680.730	32.7033317	-108.1105310	--	--	N		
STS-BWC-2011-11		FS Data Collection, submitted herein	2011	0-6"	2 mm sieve (a)		619593.670	2639833.954	32.7030156	-108.1037374	--	--	N		
STS-BWC-2011-12		FS Data Collection, submitted herein	2011	0-6"	2 mm sieve (a)		621414.312	2639223.425	32.7079274	-108.1064946	--	--	N		
STS-BWC-2011-13		FS Data Collection, submitted herein	2011	0-6"	2 mm sieve (a)		613790.637	2633050.616	32.6868740	-108.1255724	--	--	N	Removed*	
STS-BWC-2011-14		FS Data Collection, submitted herein	2011	0-6"	2 mm sieve (a)		613062.165	2633356.275	32.6851329	-108.1251801	--	--	N	Removed*	
STS-BWC-2011-1		FS Data Collection, submitted herein	2011	0-6"	2 mm sieve (a)		617044.637	2640750.337	32.6962491	-108.1010246	--	--	N		
STS-BWC-2011-2		FS Data Collection, submitted herein	2011	0-6"	2 mm sieve (a)		618500.666	2640446.396	32.6995767	-108.1014987	--	--	N		
STS-BWC-2011-3		FS Data Collection, submitted herein	2011	0-6"	2 mm sieve (a)		619590.553	2641064.367	32.7031367	-108.1004881	--	--	N		
STS-BWC-2011-4		FS Data Collection, submitted herein	2011	0-6"	2 mm sieve (a)		618503.807	2639215.941	32.6999784	-108.1058328	--	--	N		
STS-BWC-2011-5		FS Data Collection, submitted herein	2011	0-6"	3 mm sieve (a)		620365.864	2640178.589	32.7051249	-108.1028860	--	--	N		
STS-BWC-2011-6		FS Data Collection, submitted herein	2011	0-6"	4 mm sieve (a)		617858.946	2640656.875	32.6982376	-108.1013105	--	--	N		
STS-RWU-2011-1		FS Data Collection, submitted herein	2013	0-6"	2 mm sieve (a)		623011.135	2638507.195	32.7124	-108.1083	--	338	N		
STS-RWU-2011-2		FS Data Collection, submitted herein	2013	0-6"	2 mm sieve (a)		620140.176	2639527.748	32.7045	-108.1050	--	381	N		
STS-RWU-2011-3		FS Data Collection, submitted herein	2013	0-6"	2 mm sieve (a)		621269.579	2638915.463	32.7076	-108.1070	--	998	N		
STS-RWU-2011-4		FS Data Collection, submitted herein	2013	0-6"	2 mm sieve (a)		623009.965	2627847.296	32.7123	-108.1430	--	427	N		
STS-RWU-2011-5		FS Data Collection, submitted herein	2013	0-6"	2 mm sieve (a)		620932.83	2642605.705	32.7067	-108.0950	--	779	N		
STS-RWU-2011-6		FS Data Collection, submitted herein	2013	0-6"	2 mm sieve (a)		621606.498	2634640.262	32.7085	-108.1209	--	1300	N		

Footnotes:
[1]PreFS RAC for copper for small ground feeding bird applies to 0-6" soil sieved to < 2 mm (2000 µm). Pre-FS RAC for human health applies to 0-1" soil sieved to < 0.25 mm (250 µm). The ratio used to convert copper concentration of 0-1" sieved at <0.25 mm soils to 0-6" sieved at < 2 mm soils is from Appendix A (median ratio of SS samples) of Arcadis (2011). Multiplied copper concentration by 0.7 if outside windblown tailings (and by 1.5 if inside windblown tailings). If unsieved, multiplied by 0.9 if outside windblown tailings and by 1.3 if inside windblown tailings. The 0.9 and 1.3 are from median ratios of unsieved 0-1" soil in 2009 lab reports (at 25 m on transect) compared to sieved 0-6" co-located soil in Drexler lab report in Appendix D of the pH Monitoring Report (Appendix B to the FS Report) for soils in and outside of windblown tailings, respectively (FID 8, 18, 20 in tailings). A subset of the data collected using x-ray fluorescence as part of the Railroad Interim Removal Action (Golder 2013) was collected at 0-2 inch" and sieved at <0.25 mm; the same ratios described here were applied to these data to estimate 0 to 6 inch bgs.
[2]Data were collected for ecological endpoint and were not corrected to human health values.
[3]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as IRA.
[4]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as HWY 180.
[5]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as 2:1 slope.
[6]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as Volcanic Rock.
[7]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as NMDOT.
[8]If two samples were collected from the same location in the same sampling year (with identical sample location coordinates), an average was used in place of the two parent samples. For the co-located samples U04-1121 (SRK 2008) and FID 18 (Arcadis 2009), samples were collected in different years, and the sample from the more recent year was used (FID 18).
*Removed samples with the asterisk are set to 327 for the Theissens analysis. All other removed samples are completely voided.
-- means no data available at the location.

TABLE 3-2
STSIU Surface Soil Copper Results Adjusted to 0-6"

STSIU Feasibility Study
Freeport-McMoRan Chino Mines Company
Vanadium, New Mexico

Location ID	Alternate ID	Source Report	Year Collected	Original Soil depth	Sieving Status	1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]	Northing (State Plane)	Easting (State Plane)	Latitude	Longitude	Copper Concentration[1] To Compare to HH Pre-FS RAC (250 µm sieve)	Copper Concentration[1] For Bird Pre-FS RAC Analysis (2000 µm sieve)	Pre-Interim Remedial Action (IRA) Dataset	Removed in Post-IRA Dataset	Reason Removed (also see this column's footnotes)
STS-RWU-2011-7		FS Data Collection, submitted herein	2013	0-6"	2 mm sieve (a)		617485.131	2639213.322	32.6972	-108.1060	--	529	N		
STS-RWU-2011-8		FS Data Collection, submitted herein	2013	0-6"	2 mm sieve (a)		622239.895	2642948.807	32.7103	-108.0939	--	287	N		
STS-RWU-2011-9		FS Data Collection, submitted herein	2013	0-6"	2 mm sieve (a)		617007.481	2641057.872	32.6959	-108.1000	--	560	N		
STS-RWU-2011-10	STS-PT-2013-29	FS Data Collection, submitted herein	2013	0-6"	2 mm sieve (a)		609319.048	2645961.777	32.6748	-108.0840	--	96	N		July 2013. Alternative Oct. 2013 sample = 234
STS-RWU-2011-11		FS Data Collection, submitted herein	2013	0-6"	2 mm sieve (a)		609288.573	2643500.09	32.6747	-108.0920	--	216	N		
STS-RWU-2011-12	STS-PT-2013-30	FS Data Collection, submitted herein	2013	0-6"	2 mm sieve (a)		605464.845	2645029.462	32.6642	-108.0870	--	316	N		July 2013. Alternative Oct. 2013 sample = 152
STS-RWU-2011-13		FS Data Collection, submitted herein	2013	0-6"	2 mm sieve (a)		610054.083	2642886.566	32.6768	-108.0940	--	305	N		
STS-RWU-2011-14	STS-PT-2013-31	FS Data Collection, submitted herein	2013	0-6"	2 mm sieve (a)		621457.93	2636455.245	32.7081	-108.1150	--	1640	N		July 2013. Alternative Oct. 2013 sample = 153
STS-RWU-2011-15		FS Data Collection, submitted herein	2013	0-6"	2 mm sieve (a)		621860.589	2635533.562	32.7092	-108.1180	--	1640	N		
STS-RWU-2011-16		FS Data Collection, submitted herein	2013	0-6"	2 mm sieve (a)		620234.14	2645679.97	32.7048	-108.0850	--	395	N		
STS-RWU-2011-17		FS Data Collection, submitted herein	2013	0-6"	2 mm sieve (a)		609837.313	2642270.639	32.6762	-108.0960	--	654	N		
WILDLIFE REFERENCE PLOT NORTH		FS Data Collection, submitted herein	2013	0-6"	2 mm sieve (a)		612649.906	2650991.742	32.6840	-108.0677	--	213	N		
WILDLIFE REFERENCE PLOT SOUTH		FS Data Collection, submitted herein	2013	0-6"	2 mm sieve (a)		609299.201	2653329.641	32.6748	-108.0601	--	288	N		July 2013. Alternative Oct. 2013 sample = 164
STS-RWU-2012-B1	STS-PT-2013-21	FS Data Collection, submitted herein	2013	0-6"	2 mm sieve (a)		608053.458	2658115.91	32.6714	-108.0445	--	182	N		July 2013. Alternative Oct. 2013 sample = 61
STS-RWU-2012-B2	STS-PT-2013-22	FS Data Collection, submitted herein	2013	0-6"	2 mm sieve (a)		608040.451	2658805.776	32.6714	-108.0423	--	344	N		July 2013. Alternative Oct. 2013 sample = 248
STS-RWU-2012-B3	STS-PT-2013-23	FS Data Collection, submitted herein	2013	0-6"	2 mm sieve (a)		608925.052	2657983.486	32.6738	-108.0449	--	161	N		July 2013. Alternative Oct. 2013 sample = 253

References:

Arcadis. 2010. AOC Terrestrial Invertebrate Copper Bioaccumulation and Bioavailability Study. Smelter/Tailing Soils Investigation Unit. Prepared for Freeport-McMoRan Chino Mines Company, Vanadium, New Mexico. (composite of 15 samples in 100-m radius plot).

Arcadis. 2011. Administrative Order on Consent Feasibility Study Proposal. Smelter Tailings Soils Investigation Unit. Prepared for Chino Mines Company, Hurley, New Mexico. October.

Chino, 1995. Administrative Order on Consent, Investigation Area, Remedial Investigation Background Report, Chino Mines Investigation Area. Prepared by Chino Mines Company, Hurley, New Mexico. Department received 28 October 1995. (one grab sample).

Newfields. 2005. Chino Mines Administrative Order on Consent Site-wide Ecological Risk Assessment. Prepared for Chino Mines Company. November. (average of 3 samples on 50-m transect).

SRK, Inc. 2008. "Chino Mines Company, Hurley, New Mexico Administrative Order on Consent, Revised Remedial Investigation Report, Smelter/Tailing Soils Investigation Unit." Revision 2. February 6. (method was composite of 6 random subsamples in 100' x 100' area)

Arcadis. 2009. STSIU Interim Removal Action, Completion Report (aka Golf Course IRA). March 10.

Golder Associates. 2013. Supplemental Completion Report, Interim Remedial Action, STSIU (aka Railroad IRA). May 28.

Arcadis. 2017. Year 5 Monitoring Report for Smelter/Tailing Soils Investigation Unit Amendment Study Plots. November.

Arcadis. 2017. Year 5 Report on pH Monitoring to Evaluate the Effect of the White Rain on the Smelter Tailing Soils Investigation Unit. September.

Golder Associates. 2015. Supplemental Completion Report, Razorback Ridge Area, Interim Remedial Action, STSIU. October 1.

Arcadis. 2020. Draft Completion Report, B Ranch Area, Interim Remedial Action, STSIU. August

Footnotes:

[1]PreFS RAC for copper for small ground feeding bird applies to 0-6" soil sieved to < 2 mm (2000 µm). Pre-FS RAC for human health applies to 0-1" soil sieved to < 0.25 mm (250 µm). The ratio used to convert copper concentration of 0-1" sieved at <0.25 mm soils to 0-6" sieved at < 2 mm soils is from Appendix A (median ratio of SS samples) of Arcadis (2011). Multiplied copper concentration by 0.7 if outside windblown tailings (and by 1.5 if inside windblown tailings). If unsieved, multiplied by 0.9 if outside windblown tailings and by 1.3 if inside windblown tailings. The 0.9 and 1.3 are from median ratios of unsieved 0-1" soil in 2009 lab reports (at 25 m on transect) compared to sieved 0-6" co-located soil in Drexler lab report in Appendix D of the pH Monitoring Report (Appendix B to the FS Report) for soils in and outside of windblown tailings, respectively (FID 8, 18, 20 in tailings). A subset of the data collected using x-ray fluorescence as part of the Railroad Interim Removal Action (Golder 2013) was collected at 0-2 inch" and sieved at <0.25 mm; the same ratios described here were applied to these data to estimate 0 to 6 inch bgs.
[2]Data were collected for ecological endpoint and were not corrected to human health values.
[3]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as IRA.
[4]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as HWY 180.
[5]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as 2:1 slope.
[6]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as Volcanic Rock.
[7]A duplicate sample with the same Loc ID has been recorded in Golf Course Interim Removal Action, Arcadis 2009. This sample was marked as NMDOT.
[8]If two samples were collected from the same location in the same sampling year (with identical sample location coordinates), an average was used in place of the two parent samples. For the co-located samples U04-1121 (SRK 2008) and FID 18 (Arcadis 2009), samples were collected in different years, and the sample from the more recent year was used (FID 18).
*Removed samples with the asterisk are set to 327 for the Theissens analysis. All other removed samples are completely voided.
-- means no data available at the location.

TABLE 3-3
STSIU SOIL COPPER 95 UCLS

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILING SOILS IU FEASIBILITY STUDY

Habitat Alliance Polygon ID	Number of Samples	Acres	Copper (mg/kg)			Ratio to 1600 Pre-FS RAC
			Minimum	Maximum	Spatially Weighted 95 UCL	
1-3	22	23	127	3204	1653	1.0
1-4	63	360	63	2527	537	0.3
1-5	2	53	1022	1120	1071 (a)	0.7
10-11	58	1785	96	1107	449	0.3
10-14	343	286	34	3463	1061	0.7
10-16	10	71	438	1640	1328	0.8
10-17	10	43	327	1560	708	0.4
10-8	55	873	160	2653	726	0.5
42-15	9	348	285	1611	503 (b)	0.3
88-10	15	107	259	1140	713	0.4
88-15	123	46	72	3463	1278	0.8
88-17	7	15	426	1560	998 (b)	0.6
88-19	82	879	34	3204	992	0.6
88-22	8	39	372	1611	705 (b)	0.4
137-7	358	116	58	3561	827	0.5
137-8	341	4127	34	3492	593	0.4
Mine Facilities/Urban	229	277	78	3565	455	0.3
Mine Facilities/Other (29-1)	253	324	14	3342	627	0.4

Notes:

mg/kg = milligram per kilogram

(a) Polygon has two samples and does not meet minimum sample count to generate bootstrap datasets and calculate a 95UCL; therefore, the average concentration was estimated.

(b) As described in Section 9.2 of the text, 95UCLs are based on the arithmetic mean (if the distribution of 95UCLs was symmetric) or geometric mean (if the distribution was asymmetric) of 500 iterations of bootstrapped datasets, which is just below the limit imposed by ProUCL 5.2 (column limit of 512). For three alliance polygons, ProUCL did not succeed on all 500 iterations of the bootstrapped datasets; Polygon 42-15 had 354 iterations, Polygon 88-17 had 149 iterations, and Polygon 88-22 had 224 iterations.

Gray shading indicates Ratio > 1 and exceeds the corresponding RAC indicated in the column heading.

TABLE 3-4
STSIU SOIL pCu VALUES

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILING SOILS IU FEASIBILITY STUDY

Location	Copper mg/kg	pH SU	pCu (calculated[1])	Latitude	Longitude	Source
ERA02	1000	6.00	4.98	32.6890	-108.1064	Appendix B
ERA03	652	5.90	5.37	32.6850	-108.1047	Appendix B
ERA04	562	5.40	5.08	32.6891	-108.0922	Appendix B
ERA05	238	6.40	7.00	32.6892	-108.0911	Appendix B
ERA06	622	6.30	5.80	32.6990	-108.0958	Appendix B
ERA07	758	6.70	5.95	32.6758	-108.0998	Appendix B
ERA08	643	7.00	6.41	32.6749	-108.1031	Appendix B
ERA09	291	4.60	5.09	32.6864	-108.0729	Appendix B
ERA10	310	5.30	5.67	32.6837	-108.0666	Appendix B
ERA11	277	7.00	7.38	32.6567	-108.0610	Appendix B
ERA12	215	7.80	8.42	32.6459	-108.0636	Appendix B
ERA13	125	5.50	6.90	32.6825	-108.0489	Appendix B
ERA14	129	7.50	8.73	32.6430	-108.1187	Appendix B
ERA15	529	7.80	7.40	32.7062	-108.1406	Appendix B
FID 10	2550	4.70	2.69	32.7056	-108.1135	Appendix B
FID 101	285	3.90	4.47	32.6732	-108.0910	Appendix B
FID 102	282	3.50	4.11	32.6624	-108.0887	Appendix B
FID 103	443	4.00	4.05	32.6553	-108.0873	Appendix B
FID 104	459	3.80	3.83	32.6646	-108.0943	Appendix B
FID 105	834	4.50	3.79	32.6873	-108.1033	Appendix B
FID 106	516	4.40	4.25	32.6728	-108.0629	Appendix B
FID 15	1850	5.60	3.90	32.6978	-108.1069	Appendix B
FID 16	1440	4.80	3.44	32.6960	-108.1071	Appendix B
FID 17	4550	6.18	2.87	32.6978	-108.1135	Appendix B
FID 18	310	4.20	4.65	32.6740	-108.0918	Appendix B
FID 22	378	6.90	6.93	32.6669	-108.0780	Appendix B
FID 23	202	4.36	4.28	32.6568	-108.0841	Appendix B
FID 28	423	7.30	7.17	32.6700	-108.0511	Appendix B
FID 37	708	4.70	4.16	32.7064	-108.0954	Appendix B
FID 43	636	6.50	5.96	32.6589	-108.0884	Appendix B
FID 7	491	5.10	4.96	32.6786	-108.0675	Appendix B
FID 8	473	4.60	4.54	32.6668	-108.0920	Appendix B
Reference Plot #1	882	8.00	6.98	32.7065	-108.1383	Appendix B
Reference Plot #2	760	6.20	5.48	32.7130	-108.1297	Appendix B
Reference Plot #3	1540	5.40	3.92	32.7038	-108.1111	Appendix B
Reference Plot #4	1020	4.90	3.93	32.6897	-108.1040	Appendix B
STS-PCUG-2011-1	263	5.60	6.14	32.6327	-108.0785	FS workplan
STS-PCUG-2011-10	324	7.4	7.57	32.6382	-108.0664	FS workplan
STS-PCUG-2011-11	254	4.60	5.25	32.6774	-108.0802	FS workplan
STS-PCUG-2011-12	536	6.70	6.34	32.6984	-108.0822	FS workplan
STS-PCUG-2011-13	602	5.10	4.72	32.7129	-108.0871	FS workplan
STS-PCUG-2011-14	354	5.90	6.08	32.6453	-108.0831	FS workplan
STS-PCUG-2011-15	357	4.30	4.58	32.6966	-108.0735	FS workplan

TABLE 3-4
STSIU SOIL pCu VALUES

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILING SOILS IU FEASIBILITY STUDY

Location	Copper mg/kg	pH SU	pCu (calculated[1])	Latitude	Longitude	Source
STS-PCUG-2011-16	864	5.2	4.40	32.7158	-108.1146	FS workplan
STS-PCUG-2011-17	994	5.10	4.15	32.7046	-108.1025	FS workplan
STS-PCUG-2011-18	1540	5.3	3.83	32.7122	-108.1140	FS workplan
STS-PCUG-2011-19	1210	3.90	2.80	32.6925	-108.1046	FS workplan
STS-PCUG-2011-2	876	6.50	5.59	32.7022	-108.0842	FS workplan
STS-PCUG-2011-20	520	4.10	3.96	32.6784	-108.0920	FS workplan
STS-PCUG-2011-21	558	4.80	4.53	32.7079	-108.0973	FS workplan
STS-PCUG-2011-22	976	7.4	6.31	32.7124	-108.1416	FS workplan
STS-PCUG-2011-23	551	5.80	5.48	32.7173	-108.1003	FS workplan
STS-PCUG-2011-24	1000	4.2	3.30	32.7102	-108.1057	FS workplan
STS-PCUG-2011-25	706	4.6	4.07	32.7077	-108.1046	FS workplan
STS-PCUG-2011-27	438	6.9	6.76	32.7170	-108.1461	FS workplan
STS-PCUG-2011-28	959	7.5	6.42	32.7162	-108.1389	FS workplan
STS-PCUG-2011-29	671	5.2	4.69	32.7185	-108.1033	FS workplan
STS-PCUG-2011-3	587	4.80	4.47	32.7013	-108.0765	FS workplan
STS-PCUG-2011-30	1500	7.4	5.81	32.7145	-108.1375	FS workplan
STS-PCUG-2011-31	304	4.30	4.76	32.6517	-108.0845	FS workplan
STS-PCUG-2011-32	420	3.80	3.93	32.6499	-108.0784	FS workplan
STS-PCUG-2011-33	273	6.7	7.12	32.6474	-108.0717	FS workplan
STS-PCUG-2011-34	364	4.00	4.28	32.6541	-108.0766	FS workplan
STS-PCUG-2011-35	287	5.50	5.95	32.6723	-108.0848	FS workplan
STS-PCUG-2011-36	270	5.60	6.11	32.6723	-108.0703	FS workplan
STS-PCUG-2011-37	244	6.90	7.44	32.6612	-108.0815	FS workplan
STS-PCUG-2011-38	350	3.90	4.23	32.6613	-108.0740	FS workplan
STS-PCUG-2011-39	360	4.70	4.94	32.6637	-108.0668	FS workplan
STS-PCUG-2011-4	794	4.60	3.94	32.7150	-108.0941	FS workplan
STS-PCUG-2011-40	312	3.80	4.27	32.6532	-108.0693	FS workplan
STS-PCUG-2011-41	587	3.30	3.08	32.6377	-108.0806	FS workplan
STS-PCUG-2011-5	458	5.8	5.69	32.7215	-108.1193	FS workplan
STS-PCUG-2011-6	290	5.00	5.47	32.6900	-108.0677	FS workplan
STS-PCUG-2011-7	387	7.7	7.65	32.7153	-108.1545	FS workplan
STS-PCUG-2011-8	449	5.8	5.71	32.7204	-108.1148	FS workplan
STS-PCUG-2011-9	246	4.80	5.47	32.6858	-108.0816	FS workplan
STS-RWU-2011-1	338	5.20	5.48	32.7124	-108.1083	Appendix C
STS-RWU-2011-10	96	4.6	6.37	32.6748	-108.0840	Appendix C
STS-RWU-2011-11	216	4.3	5.16	32.6747	-108.0920	Appendix C
STS-RWU-2011-12	316	3.9	4.35	32.6642	-108.0870	Appendix C
STS-RWU-2011-13	305	5.6	5.97	32.6768	-108.0940	Appendix C
STS-RWU-2011-14	1640	5.3	3.76	32.7081	-108.1150	Appendix C
STS-RWU-2011-15	1640	5.7	4.13	32.7092	-108.1180	Appendix C
STS-RWU-2011-16	395	4.9	5.02	32.7048	-108.0850	Appendix C
STS-RWU-2011-17	654	4.6	4.16	32.6762	-108.0960	Appendix C
STS-RWU-2011-2	381	4.10	4.32	32.7045	-108.1050	Appendix C
STS-RWU-2011-3	998	5.10	4.14	32.7076	-108.1070	Appendix C
STS-RWU-2011-4	427	7.20	7.07	32.7123	-108.1430	Appendix C
STS-RWU-2011-5	779	4.60	3.96	32.7067	-108.0950	Appendix C
STS-RWU-2011-6	1300	7.30	5.88	32.7085	-108.1209	Appendix C
STS-RWU-2011-7	529	4.90	4.69	32.6972	-108.1060	Appendix C
STS-RWU-2011-8	287	5.60	6.04	32.7103	-108.0939	Appendix C
STS-RWU-2011-9	560	4.4	4.15	32.6959	-108.1000	Appendix C
STS-RWU-2012-B1	182	4.6	5.63	32.6714	-108.0445	Appendix C
STS-RWU-2012-B2	344	4.7	4.99	32.6714	-108.0423	Appendix C
STS-RWU-2012-B3	161	4.7	5.87	32.6738	-108.0449	Appendix C
STS-SS-2010-016	1211	4.9	3.73	32.7070	-108.1121	FS workplan

TABLE 3-4
STSIU SOIL pCu VALUES

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILING SOILS IU FEASIBILITY STUDY

Location	Copper mg/kg	pH SU	pCu (calculated[1])	Latitude	Longitude	Source
STS-SS-2010-017	2227	6	4.06	32.6971	-108.1080	FS workplan
STS-SS-2010-018	1162	6	4.80	32.7039	-108.1083	FS workplan
West Amendment Plot	1767	7.68	5.96	32.7059	-108.1378	Appendix A
Wildlife Reference Plot North	213	5.90	6.66	32.6840	-108.0677	Appendix C
Wildlife Reference Plot South	288	4.60	5.11	32.6748	-108.0601	Appendix C
ERA16	77	6.10	8.02	32.6108	-108.1969	Appendix B
ERA162	153	6.49	7.59	32.7654	-108.1026	Appendix B
ERA163	146	6.95	8.08	32.7691	-108.1083	Appendix B
ERA164	95	5.62	7.33	32.7435	-108.0096	Appendix B
ERA165	124	6.90	8.21	32.7491	-108.0258	Appendix B
ERA17	57	5.63	7.93	32.6131	-108.1921	Appendix B
ERA18	73	6.07	8.04	32.6141	-108.1868	Appendix B
ERA19	62	6.68	8.80	32.6093	-108.1838	Appendix B
ERA20	45	7.73	10.15	32.6089	-108.1854	Appendix B
ERA21	48	6.20	8.65	32.6080	-108.1875	Appendix B
ERA25	70	7.73	9.64	32.6729	-108.0461	Appendix B
ERA27	328	5.77	6.04	32.6183	-108.0861	Appendix B
ERA28	1060	7.53	6.34	32.7472	-108.1298	Appendix B
ERA31	78	7.73	9.53	32.5797	-108.0458	Appendix B
ERA33	176	6.60	7.53	32.7655	-108.1161	Appendix B
S64	482	7.49	7.20	32.7494	-108.1323	Appendix B
S65	462	4.78	4.73	32.7437	-108.1310	Appendix B
S66	552	6.61	6.23	32.7387	-108.1315	Appendix B
S78	207	7.79	8.45	32.6222	-108.1271	Appendix B
S79	157	7.95	8.92	32.6221	-108.1108	Appendix B
SS100	164	6.17	7.21	32.7632	-108.0651	Appendix B
SS101	144	6.95	8.09	32.7608	-108.0469	Appendix B
SS103	348	4.52	4.81	32.7443	-108.1389	Appendix B
SS104	285	5.70	6.14	32.7511	-108.1130	Appendix B
SS107	136	5.53	6.84	32.7332	-108.0754	Appendix B
SS108	176	6.62	7.55	32.7350	-108.0302	Appendix B
SS113	146	6.93	8.05	32.7371	-108.0612	Appendix B
SS114	83	6.92	8.69	32.7278	-108.0340	Appendix B
SS119D	125	6.10	7.46	32.7224	-108.0570	Appendix B
SS120	83	7.18	8.93	32.7066	-108.0350	Appendix B
SS123	314	5.74	6.07	32.6995	-108.0382	Appendix B
SS148	442	3.96	4.02	32.6256	-108.0813	Appendix B
SS149	440	8.16	7.93	32.6248	-108.0724	Appendix B
SS150	424	8.06	7.88	32.6248	-108.0590	Appendix B
SS151	181	7.97	8.77	32.6170	-108.1193	Appendix B
SS152	166	8.24	9.13	32.6131	-108.1027	Appendix B
SS153	307	6.78	7.06	32.6115	-108.0862	Appendix B
SS154	260	7.75	8.15	32.6133	-108.0732	Appendix B
SS155	271	8.10	8.43	32.6136	-108.0593	Appendix B
SS156	137	5.06	6.39	32.5993	-108.0860	Appendix B
SS157	99	8.09	9.58	32.5990	-108.0725	Appendix B
SS158	173	7.98	8.84	32.5993	-108.0582	Appendix B
SS97	288	5.97	6.38	32.7519	-108.1471	Appendix B
SS98	333	5.97	6.21	32.7474	-108.1250	Appendix B
SS99	65	5.77	7.91	32.7586	-108.0924	Appendix B
T-09	581	7.14	6.66	32.6283	-108.0801	Appendix B
T-12	194	7.78	8.52	32.6081	-108.0947	Appendix B
U04-1019	221	5.94	6.66	32.6957	-108.0365	Appendix B
U04-1020	392	4.63	4.78	32.6977	-108.0457	Appendix B

TABLE 3-4
STSIU SOIL pCu VALUES

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILING SOILS IU FEASIBILITY STUDY

Location	Copper mg/kg	pH SU	pCu (calculated[1])	Latitude	Longitude	Source
U04-1021	252	5.76	6.34	32.6886	-108.0381	Appendix B
U04-1032	936	7.92	6.84	32.7048	-108.1562	Appendix B
U04-1033	506	8.78	8.34	32.6976	-108.1560	Appendix B
U04-1034	382	8.65	8.55	32.6892	-108.1566	Appendix B

Notes:
mg/kg = milligram per kilogram
SU = standard unit
[1] used upland pCu equation from NewFields 2005, applied all points in table to pCu contours developed with natural neighbor method.
All samples taken from the 0-6" bgs interval or adjusted to 0-6" interval with sieving at < 2 mm (see Table E-1 in Appendix B)

TABLE 3-5
ERROR MATRICES

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILING SOILS IU FEASIBILITY STUDY

Rangeland Condition Classification[1]

Classified	Observed: Unacceptable	Observed: Acceptable	User's Accuracy	Error of Commission
Unacceptable	2	0	**100%**	**0%**
Acceptable	1	5	**83%**	**17%**
Producer's Accuracy	**67%**	**100%**		
Error of Omission	**33%**	**0%**		

Overall Accuracy: **88%**

1. Based on a comparison of 2011 ground-verified OAT scores on 200-m transect that were independent of training dataset (1/4 of total dataset was not used for training) compared to majority classified rangeland class within the 200 m x 200 m area. Training dataset had 74% overall accuracy (18% error of commission), and all data produced 74% accuracy.

Vegetation Cover Classification[2]

Classified	Observed: Unacceptable	Observed: Acceptable	User's Accuracy	Error of Commission
Unacceptable	9	5	**64%**	**36%**
Acceptable	3	14	**82%**	**18%**
Producer's Accuracy	**75%**	**74%**		
Error of Omission	**25%**	**26%**		

Overall Accuracy: **74%**

2. Based on a comparison of 2011 ground visit assessed vegetative cover independent of process of developing the mapped rangeland polygons of cover.

Vegetation Richness Classification[3]

Classified	Observed: Unacceptable	Observed: Acceptable	User's Accuracy	Error of Commission
Unacceptable	16	5	**76%**	**24%**
Acceptable	4	6	**60%**	**40%**
Producer's Accuracy	**80%**	**55%**		
Error of Omission	**20%**	**45%**		

Overall Accuracy: **71%**

3. Based on a comparison of 2011 ground visit assessed vegetative richness independent of process of developing mapped rangeland polygons of richness.

TABLE 3-6
VALIDATION SITE RESULTS

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILING SOILS IU FEASIBILITY STUDY

Location	Soil Category Observed	Soil Category Classified	Rangeland Condition (OAT)		Vegetation Cover	
			Observed	Classified	Observed	Classified
STS-PT-2013-1	Flat Rocky	Flat Rocky	Unacceptable	Unacceptable	Acceptable	Acceptable
STS-PT-2013-2	Flat Rocky	Slope > 13%	Unacceptable	Unacceptable	Acceptable	Acceptable
STS-PT-2013-5	Slope > 13%	Slope > 13%	Acceptable	Acceptable	Acceptable	Acceptable
STS-PT-2013-9	Bedrock	Bedrock	Unacceptable	Unacceptable	Unacceptable	Unacceptable
STS-PT-2013-12	Bedrock	Bedrock	Acceptable	Acceptable	Acceptable	Acceptable
STS-PT-2013-17	Flat Rocky	Flat Rocky	Unacceptable	Unacceptable	Acceptable	Unacceptable
STS-PT-2013-19	Flat Rocky	Flat Rocky	Unacceptable	Unacceptable	Unacceptable	Unacceptable
STS-PT-2013-20	Flat Granular	Flat Granular	Acceptable	Acceptable	Acceptable	Acceptable
STS-RWU-2012-B1	Bedrock	Flat Rocky	Acceptable	Unacceptable	Acceptable	Unacceptable
STS-RWU-2012-B2	Bedrock	Flat Rocky	Unacceptable	Unacceptable	Unacceptable	Unacceptable
STS-RWU-2012-B3	Bedrock	Slope > 13%	Acceptable	Unacceptable	Unacceptable	Unacceptable
STS-RWU-2011-1	Bedrock	Bedrock	Unacceptable	Unacceptable	Unacceptable	Acceptable
STS-RWU-2011-2	Bedrock	Bedrock	Unacceptable	Unacceptable	Acceptable	Acceptable
STS-RWU-2011-3	Slope > 13%	Flat Granular	Acceptable	Acceptable	Acceptable	Acceptable
STS-RWU-2011-4	Flat Granular	Flat Granular	Acceptable	Acceptable	Acceptable	Acceptable
STS-RWU-2011-5	Flat Granular	Flat Rocky	Acceptable	Unacceptable	Acceptable	Unacceptable
STS-RWU-2011-6	Slope > 13%	Slope > 13%	Unacceptable	Acceptable	Unacceptable	Acceptable
STS-RWU-2011-7	Flat Rocky	Bedrock	Unacceptable	Unacceptable	Unacceptable	Unacceptable
STS-RWU-2011-8	Slope > 13%	Slope > 13%	Acceptable	Acceptable	Acceptable	Acceptable
STS-RWU-2011-9	Bedrock	Bedrock	Unacceptable	Unacceptable	Unacceptable	Unacceptable
STS-RWU-2011-10	Flat Granular	Flat Rocky	Unacceptable	Unacceptable	Acceptable	Unacceptable
STS-RWU-2011-11	Bedrock	Bedrock	Unacceptable	Unacceptable	Unacceptable	Unacceptable
STS-RWU-2011-12	Flat Rocky	Flat Rocky	Unacceptable	Unacceptable	Unacceptable	Unacceptable
STS-RWU-2011-13	Flat Granular	Flat Rocky	Unacceptable	Unacceptable	Acceptable	Unacceptable
STS-RWU-2011-14	Slope > 13%	Slope > 13%	Acceptable	Acceptable	Unacceptable	Acceptable
STS-RWU-2011-15	Flat Granular	Flat Rocky	Unacceptable	Unacceptable	Acceptable	Acceptable
STS-RWU-2011-16	Flat Granular	Bedrock	Acceptable	Acceptable	Acceptable	Acceptable
STS-RWU-2011-17	Flat Rocky	Flat Granular	Unacceptable	Acceptable	Acceptable	Acceptable
Overgrazed Reference	Flat Rocky	Flat Rocky	Unacceptable	Unacceptable	Unacceptable	Unacceptable
Wildlife reference plot S	Flat Granular	Flat Rocky	Acceptable	Acceptable	Acceptable	Acceptable
Wildlife reference plot N	Flat Granular	Flat Rocky	Acceptable	Acceptable	Acceptable	Acceptable

Bolded are independent data used to assess OAT score accuracy.

TABLE 3-7
EVALUATION OF SOIL CATEGORIES BASED ON PROBABLE EFFECT LEVELS (PELS)
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILING SOILS IU FEASIBILITY STUDY

Soil category	PEL	Minimum pCu of retained polygons	Below PEL and include for remediation?
Flat Rocky	4.98	3.65	**Yes, include**
Slope > 13%	4.11	3.84	**Yes, include**
Bedrock	4.4	3.86	**Yes, include**
Flat Granular	4.11	NA	No, exclude

TABLE 4-1
SURFACE WATER CRITERIA EVALUATION FOR METALS - EPHEMERAL WATERSHEDS

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILING SOILS IU FEASIBILITY STUDY

				Aluminum				Cadmium						Lead					
Stream Location	Year	Hardness (mg/L)	pH	Q	Dissolved or Total Al (µg/L)[a]	Chronic Criteria (µg/L)	Chronic Hardness-based HQ	Q	Dissolved Cd (µg/L)	Acute Criteria (µg/L)	Acute Hardness-based HQ	Chronic Criteria (µg/L)	Chronic Hardness-based HQ	Q	Dissolved Pb (µg/L)	Acute Criteria (µg/L)	Acute Hardness-based HQ	Chronic Criteria (µg/L)	Chronic Hardness-based HQ
Lampbright Draw Watershed																			
Lampbright Draw						1 if Windblown Tailing (WBT) adjustment needed for 0-1" soil[1]													
ERA 25	2000	187	--		--	3230	**--**	<	1.5	3.2	0.5	1.1	*1*	<	20	127.3	0.16	5.0	*4*
ERA 45	2000	202	--		--		**--**	<	1.5	3.5	0.4	1.2	*1*	<	20	138.2	0.14	5.4	*4*
Sub-Watershed A																			
A-Drainage																			
STS-WS-2010-A2	2010	32	5.78*		374		#DIV/0!		0.2	0.6	0.3	0.3	0.7		1.2	18.5	0.1	0.7	**2**
STS-WS-2010-A4	2010	30	7.4		21200		#DIV/0!		0.1	0.6	0.2	0.3	0.3		0.3	17.1	0.02	0.7	0.5
2013-STS-SW-B-AS	2013	233	7.6		92		#DIV/0!	<	0.1	4.0	0.03	1.4	0.1	<	0.1	160.7	0.001	6.3	0.02
2013-SW-WER-7	2013	78	7.4		640		#DIV/0!		0.2	1.4	0.1	0.6	0.3		2.2	49.4	0.04	1.9	1
Sub-Watershed B																			
B-Drainage																			
WER-1-7	2011	108	7.2		269		#DIV/0!	B	0.1	1.9	0.1	0.8	0.1	B	0.2	70.6	0.003	2.8	0.1
STS-WS-2010-B-3	2010	111	7.5		1360		#DIV/0!		0.1	2.0	0.1	0.8	0.1		0.1	72.6	0.001	2.8	0.04
C-1 Drainage (downgradient of Bolton Canyon Confluence)																			
STS-WS-2010-C-1	2010	62	8.4		49		#DIV/0!		0.2	1.1	0.2	0.5	0.4		0.1	38.3	0.003	1.5	0.1
STS-WS-2010-C-2	2010	53	8.9		22		#DIV/0!		0.1	1.0	0.1	0.4	0.2		0.1	32.2	0.003	1.3	0.1
WER-1-5	2011	64	6.9		263		#DIV/0!	B	0.2	1.2	0.2	0.5	0.4	B	0.3	40.0	0.01	1.6	0.2
BD4W-1-2004	2004	68	7.1	B	145		#DIV/0!		1.2	1.3	1	0.5	**2**	<	1.8	42.6	0.04	1.7	*1*
BD4W-1-2007	2007	70			428		#DIV/0!		0.6	1.3	0.5	0.5	1	<	0.5	43.8	0.01	1.7	0.3
2013-SW-WER-5	2013	63	6.7		82		#DIV/0!		0.4	1.2	0.3	0.5	0.8		0.1	39.0	0.00	1.5	0.1
C-2 Drainage																			
ERA37	2000	103	--		--		**--**	<	1.5	1.8	0.8	0.7	*2*	<	20.0	66.9	0.30	2.6	*8*
WER-1-BD	2011	66	7.4		211		#DIV/0!	<	0.1	1.2	0.1	0.5	0.2	B	0.3	41.0	0.01	1.6	0.2
2013-SW-WER-BD	2013	35	7.7		1070		**#DIV/0!**	<	0.1	0.7	0.1	0.3	0.3		0.4	20.3	0.02	0.8	0.5
2013-SW-C2-Lower	2013	45	7.4		952		**#DIV/0!**	<	0.1	0.9	0.1	0.4	0.3		0.2	26.9	0.01	1.0	0.2
Sub-Watershed D																			
D-1 Drainage																			
WER-1-D1-2	2011	52	7.4		712		#DIV/0!	<	0.1	1.0	0.1	0.4	0.2	B	0.5	31.6	0.02	1.2	0.4
WER-1-D1	2011	27	7.7		114		#DIV/0!	<	0.1	0.5	0.2	0.3	0.4	B	0.3	15.0	0.02	0.6	0.5
WER-2-D12	2011	57	7.5		1060		#DIV/0!	<	0.1	1.1	0.1	0.5	0.2	<	0.1	34.9	0.003	1.4	0.1
STS-WS-2010-D1-2	2010	56	6.8		36		#DIV/0!		0.1	1.0	0.1	0.5	0.2		0.1	34.2	0.003	1.3	0.1
2013-SW-WERDI-2	2013	44	7.0		2890		**#DIV/0!**		0.1	0.8	0.1	0.4	0.3		1.1	26.2	0.04	1.0	1
D-2 Drainage																			
WER-1-D2-1	2011	44	6.6		1600		**#DIV/0!**	<	0.1	0.8	0.1	0.4	0.3	B	0.4	26.2	0.02	1.0	0.4
WER-D2-2	2011	55	7.0		582		#DIV/0!	<	0.1	1.0	0.1	0.5	0.2	B	0.4	33.4	0.01	1.3	0.3
STS-WS-2010-D2-1	2010	47	5.59*		10		#DIV/0!		0.1	0.9	0.1	0.4	0.2		0.2	28.4	0.01	1.1	0.2
2013-SW-D2	2013	22	6.9		216		#DIV/0!		0.1	0.4	0.2	0.2	0.4	<	0.1	12.0	0.01	0.5	0.2
D-3 Drainage																			
CDW-1-2004	2004	53	6.1*		41		#DIV/0!		1.5	1.0	**2**	0.4	**3**	<	1.8	32.4	0.1	1.3	*1*
CDW-1-2007	2007	35	5.42*		52		#DIV/0!		1.3	0.7	**2**	0.3	**4**		0.2	20.3	0.010	0.8	0.3
CDW-1-2013	2013	37	5.9*		38		#DIV/0!		1.4	0.7	**2**	0.3	**4**	<	0.1	21.6	0.005	0.8	0.1
ERA38	2000	94	--		--		**--**		5.6	1.7	**3**	0.7	**8**	<	20.0	60.6	0.3	2.4	*8*
Sub-Watershed G																			
G-Drainage																			
WER-1-11	2011	164	6.4		21		#DIV/0!	<	0.1	2.8	0.04	1.0	0.1	<	0.1	110.5	0.001	4.3	0.02
WER-2-11	2011	119	7.6		1260		#DIV/0!	<	0.1	2.1	0.05	0.8	0.1	B	0.2	78.1	0.003	3.0	0.1

	Nickel						Silver					Zinc					
Stream Location	Q	Dissolved Ni (µg/L)	Acute Criteria (µg/L)	Acute Hardness-based HQ	Chronic Criteria (µg/L)	Chronic Hardness-based HQ	Q	Dissolved Ag (µg/L)	Acute Criteria (µg/L)	Acute Hardness-based HQ	Chronic Criteria (µg/L)	Q	Dissolved Zn (µg/L)	Acute Criteria (µg/L)	Acute Hardness-based HQ	Chronic Criteria (µg/L)	Chronic Hardness-based HQ
Lampbright Draw Watershed																	
Lampbright Draw																	
ERA 25	<	5.0	795	0.01	88	0.1		--	9.4	--	NA	<	5.0	283	0.02	214	0.02
ERA 45		--	849	--	94	--		--	10.8	--	NA		--	303	--	230	--
Sub-Watershed A																	
A-Drainage																	
STS-WS-2010-A2		--	180	--	20	--		--	0.5	--	NA		14.0	57	0.2	43	0.3
STS-WS-2010-A4		--	169	--	19	--		--	0.4	--	NA		8.0	54	0.1	41	0.2
2013-STS-SW-B-AS		--	958	--	106	--		--	13.8	--			8.0	345	0.0	262	0.03
2013-SW-WER-7		--	379	--	42	--		--	2.1	--			41.0	128	0.3	97	0.4
Sub-Watershed B																	
B-Drainage																	
WER-1-7		--	500	--	56	--		--	3.7	--	NA		3.0	172	0.02	130	0.02
STS-WS-2010-B-3		--	512	--	57	--		--	3.9	--	NA		2.0	176	0.01	133	0.01
C-1 Drainage (downgradient of Bolton Canyon Confluence)																	
STS-WS-2010-C-1		--	312	--	35	--		--	1.4	--	0.0		10.0	104	0.1	78	0.1
STS-WS-2010-C-2		--	274	--	30	--		--	1.1	--	0.0		7.0	90	0.1	68	0.1
WER-1-5		--	323	--	36	--		--	1.5	--	0.0		8.0	107	0.1	81	0.1
BD4W-1-2004		2.6	339	0.01	38	0.1		0.6	1.7	0.3	0.0		23.2	113	0.2	86	0.3
BD4W-1-2007		--	346	--	38	--		--	1.7	--	0.0		--	116	--	88	--
2013-SW-WER-5		--	317	--	35	--			1.5	--	0.0		10.0	105	0.1	80	0.1
C-2 Drainage																	
ERA37		5.0	480	0.01	53	0.1		--	3.4	--	0.0		5.0	164	0.03	124	0.04
WER-1-BD		--	329	--	37	--		--	1.6	--	0.0		2.0	110	0.02	83	0.02
2013-SW-WER-BD		--	193	--	21	--		--	0.5	--	0.0		4.0	62	0.1	47	0.1
2013-SW-C2-Lower		--	238	--	26	--		--	0.8	--	0.0		2.0	77	0.03	59	0.0
Sub-Watershed D																	
D-1 Drainage																	
WER-1-D1-2		--	270	--	30	--		--	1.0	--	0.0		3.0	88	0.03	67	0.04
WER-1-D1		--	153	--	17	--		--	0.3	--	0.0		10.0	48	0.2	37	0.3
WER-2-D12		--	291	--	32	--		--	1.2	--	0.0		2.0	96	0.02	73	0.0
STS-WS-2010-D1-2		--	286	--	32	--		--	1.2	--	0.0		9.0	94	0.1	71	0.1
2013-SW-WERDI-2		--	234	--	26	--		--	0.8	--	0.0		14.0	76	0.2	57	0.2
D-2 Drainage																	
WER-1-D2-1		--	234	--	26	--		--	0.8	--	0.0		3.0	76	0.04	57	0.1
WER-D2-2		--	281	--	31	--		--	1.1	--	0.0		3.0	92	0.03	70	0.0
STS-WS-2010-D2-1		--	248	--	28	--		--	0.9	--	0.0		19.0	81	0.2	61	0.3
2013-SW-D2		--	130	--	14	--		--	0.2	--	0.0		3.0	40	0.1	31	0.1
D-3 Drainage																	
CDW-1-2004		3.3	275	0.01	31	0.1		0.6	1.1	0.6	0.0		40.3	90	0.4	68	0.6
CDW-1-2007		--	193	--	21	--		--	0.5	--	0.0		--	62	--	47	--
CDW-1-2013		--	202	--	22	--		--	0.6	--	0.0		31.0	65	0.5	49	0.6
ERA38		5.0	444	0.01	49	0.1		--	2.9	--	0.0		--	151	--	115	--
Sub-Watershed G																	
G-Drainage																	
WER-1-11		--	711	--	79	--		--	7.5	--	0.0		3.0	251	0.01	190	0.02
WER-2-11		--	542	--	60	--		--	4.3	--	0.0		5.0	187	0.03	142	0.04

Notes:

[a]Acute & Chronic Criteria Calculated with equation 1 (acute) or 2 (chronic) of New Mexico Administrative Code (NMAC) 20.6.4.900(I), Effective February 8, 2023. However, for Aluminum, hardness-adjusted total aluminum criteria are applied to water of pH 6.5 to 9; Only Acute criteria are applicable to these ephemeral drainages.
if outside that range, dissolved Al is compared to 750 µg/L for acute criteria and 87 µg/L for chronic criteria. Dissolved is reported if outside the pH range, and total is inside the range, unless total aluminum is unavailable
* = pH outside of =6.5 to 9 range and therefore Aluminum is reported as dissolved. If pH unknown, assumed to be average for reach when selecting criteria for comparison
Q = qualifier, if non-detect (<), method detection limit shown
Bold = HQ > 1. If italicized bold and gray, the HQ is based on non-detect value and is not reliable
Calculation equations to adjust for hardness are shown below:

Acute and Chronic Calculations for Hardness-Dependent			
Acute (µg/L)			
Metal	**m_A**	**b_A**	**Conversion factor (CF)**
Aluminum (Al)	1.37	1.8308	
Cadmium (Cd)	0.979	-3.866	1.136672-[(ln hardness)(0.041838)]
Chromium (Cr) III	0.819	3.7256	0.316
Copper (Cu)	0.942	-1.7	0.96
Lead (Pb)	1.273	-1.46	1.46203-[(ln hardness)(0.145712)]
Manganese (Mn)	0.333	6.4676	
Nickel (Ni)	0.846	2.255	0.998
Silver (Ag)	1.72	-6.59	0.85
Zinc (Zn)	0.909	0.9095	0.978
Chronic			
Metal	**m_C**	**b_C**	**Conversion factor (CF)**
Aluminum (Al)	1.37	0.9161	
Chromium (Cr) III	0.819	0.6848	0.86
Copper (Cu)	0.855	-1.702	0.96
Manganese (Mn)	0.333	5.8743	
Nickel (Ni)	0.846	0.0584	0.997
Zinc (Zn)	0.909	0.6235	0.986
Criteria (µg/L) = exp(mA [ln(hardness)] + bA)(CF)			

TABLE 4-2
SURFACE WATER CRITERIA EVALUATION FOR METALS - NON-EPHEMERAL WATERSHEDS

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILING SOILS IU FEASIBILITY STUDY

Stream Location	Year	Hardness (mg/L)	pH	Aluminum Q	Dissolved or Total Al (μg/L)[a]	Acute Criteria (μg/L)	Acute Hardness-based HQ	Chronic Criteria (μg/L)	Chronic Hardness-based HQ	Cadmium Q	Dissolved Cd (μg/L)	Acute Criteria (μg/L)	Acute Hardness-based HQ	Chronic Criteria (μg/L)	Chronic Hardness-based HQ
Lucky Bill Canyon															
WER-1-2	2011	81	6.33*		6.0	750	0.01	1025	0.0	<	0.1	1.5	0.1	0.6	0.2
WER-1-1	2011	91	7.1		32	3005	0.01	1204	0.03	<	0.1	1.6	0.1	0.7	0.1
WER-2-1	2011	97	7.5		29	3271	0.01	1310	0.02	<	0.1	1.7	0.1	0.7	0.1
STS-CA-2010-004	2010	93	7.2		1	3097	--	1241	--	<	0.1	1.7	0.1	0.7	0.1
SW01-2007	2007	46	6.5		2110	1181	**2**	473	**4**	<	0.1	0.9	0.1	0.4	0.2
SW02-2007	2007	63	7.1		742	1817	0.4	728	1	<	0.1	1.2	0.1	0.5	0.2
SW03-2007	2007	95	7.5		384	3189	0.1	1277	0.3	<	0.1	1.7	0.1	0.7	0.1
SW01-2006	2006	69	6.9		535	2058	0.3	824	0.6	<	0.3	1.3	0.2	0.5	0.6
SW02-2006	2006	255	6.9	B	14.6	12348	0.001	4947	0.0	<	0.3	4.3	0.1	1.5	0.2
SW03-2006	2006	223	6.9	<	6.9	10237	0.001	4101	0.0	<	0.3	3.8	0.1	1.3	0.2
Martin Canyon															
STS-CA-2010-008	2010	139	8.3		47	5370	0.01	2151	0.02	<	0.1	2.4	0.04	0.9	0.1
STS-WS-2010-MC	2010	141	--		46.7	5476	0.01	2194	0.02	<	0.1	2.5	0.04	0.9	0.1
SW06A-2007	2007	25	6.7		129	512	0.3	205	0.6	<	0.1	0.5	0.2	0.3	0.4
SW07-2006	2006	90	7.9		31	2971	0.01	1190	0.03	<	0.2	1.6	0.1	0.7	0.3
SW07-2007	2007	97	7.6		49	3281	0.01	1314	0.04	<	0.1	1.7	0.1	0.7	0.1
SW08-2006	2006	152	7.3		31	6073	0.01	2433	0.01	<	0.2	2.7	0.1	1.0	0.2
SW08-2007	2007	109	7.3		27	3849	0.01	1542	0.02	<	0.1	1.9	0.1	0.8	0.1
WER-1-10	2011	258	7.4		32	12505	0.003	5010	0.01	<	0.1	4.3	0.02	1.5	0.1
WER-1-9	2011	86	7.5		67	2785	0.02	1116	0.1	<	0.1	1.6	0.1	0.6	0.2
WER-2-9	2011	86	8.5		307	2763	0.1	1107	0.3	<	0.1	1.6	0.1	0.6	0.2
WER-MC-1	2011	105	7.5		40	3672	0.01	1471	0.03	<	0.1	1.9	0.1	54.3	0.0
Rustler Canyon															
STS-CA-2010-001	2010	73	7.6		16	2223	0.007	891	0.018	<	0.1	1.3	0.1	0.6	0.2
SW05-2006	2006	345	5.42*		1030	750	1	7484	**0**	B	1.4	5.7	0.2	1.8	0.8
SW05-2007	2007	365	4.17*		11200	750	**15**	8071	**1**		3.8	6.0	0.6	1.9	**2**
SW06-2006	2006	41	7.2		34	998	0.03	400	0.1	<	0.3	0.8	0.4	0.4	0.8
SW09-2006	2006	130	8.2	B	17	4881	0.003	1955	0.01	<	0.2	2.3	0.1	0.9	0.2
SW09-2007	2007	119	6.36*		22	750	0.03	1739	0.0	<	0.1	2.1	0.05	0.8	0.1
SW-10-2006	2006	89	7.3	<	12	2901	0.004	1162	0.01	<	0.2	1.6	0.1	0.7	0.3
SW10-2007	2007	74	6.5		13	2265	0.01	907	0.01	<	0.1	1.4	0.1	0.6	0.2
SW-210-2006	2006	89	7.2	B	17	2933	0.01	1175	0.01	<	0.2	1.6	0.1	0.7	0.3
WER-1-12	2011	74	6.09*		5	750	0.01	907	0.0	<	0.1	1.4	0.1	0.6	0.2
WER-1-RCS1	2011	45	8.7		14	1129	0.01	453	0.03	<	0.1	0.8	0.1	0.4	0.3
WER-1-RCS2	2011	40	7.3		21	982	0.02	394	0.1	<	0.1	0.8	0.1	0.4	0.3
WER-1-RCS3	2011	67	6.15*		2	750	0.003	792	0.00	<	0.1	1.2	0.1	0.5	0.2
WER-2-12	2011	69	7.3		123	2058	0.1	824	0.1	<	0.1	1.3	0.1	0.5	0.2
Sub-Watershed C															
C-1 Drainage (upgradient of Bolton Canyon Confluence)															
STS-WS-2010-C-3	2010	57	7.0		38	1584	0.02	604	0.1		0.1	1.1	0.1	0.5	0.2
WER-1-6	2011	54	6.42*		12	750	0.02	516	0.0	<	0.1	1.0	0.1	0.5	0.2
WER-2-6	2011	47	6.9		282	1216	0.2	530	0.5	<	0.1	0.9	0.1	0.4	0.2
2013-SW-WER-6	2013	30	6.6		101	658	0.2	545	0.2		0.1	0.6	0.2	0.3	0.3
2013-SW-C-BS	2013	47	7.8		342	1216	0.3	530	0.6	<	0.1	0.9	0.1	0.4	0.2
2013-SW-C-BS-D	2013	41	9.12*		56	750	0.1	574	0.1		0.1	0.8	0.1	0.4	0.3
2013-SW-C-BC	2013	29	6.9		372	628	0.6	589	1	<	0.1	0.6	0.2	0.3	0.4
C-2 Drainage of Sub-Watershed C (upstream from confluence and in CLF critical habitat)															
2013-SW-C2-Lower	2013	45	7.4		952	1146	0.8		**#DIV/0!**	<	0.1	0.9	0.1	0.4	0.3
2013-SW-C2-Upper	2013	48	7.4		779	1252	0.6		**#DIV/0!**	<	0.1	0.9	0.1	0.4	0.2

Stream Location	Lead Q	Dissolved Pb (μg/L)	Acute Criteria (μg/L)	Acute Hardness-based HQ	Chronic Criteria (μg/L)	Chronic Hardness-based HQ	Nickel Q	Dissolved Ni (μg/L)	Acute Criteria (μg/L)	Acute Hardness-based HQ	Chronic Criteria (μg/L)	Chronic Hardness-based HQ
Lucky Bill Canyon												
WER-1-2	<	0.1	51	0.002	2.0	0.05		--	391.4	--	43	--
WER-1-1	<	0.1	58	0.002	2.3	0.04		--	432.2	--	48	--
WER-2-1	<	0.1	63	0.002	2.4	0.04		--	455.5	--	51	--
STS-CA-2010-004	<	0.1	60	0.002	2.3	0.04		--	440.4	--	49	
SW01-2007		0.3	28	0.011	1.1	0.3		--	242.7	--	27	--
SW02-2007		0.2	39	0.005	1.5	0.1		--	316.7	--	35	--
SW03-2007		0.5	61	0.008	2.4	0.2		--	448.4	--	50	--
SW01-2006	<	1.5	43	0.035	1.7	0.9	<	1.9	342.1	0.006	38	0.1
SW02-2006	B	2.8	177	0.016	6.9	0.4	<	1.9	1034.8	0.002	115	0.02
SW03-2006	<	1.5	153	0.010	6.0	0.3	<	1.9	921.6	0.002	102	0.02
Martin Canyon												
STS-CA-2010-008		0.6	93	0.006	3.6	0.2		--	618.7	--	69	--
STS-WS-2010-MC		0.5	94	0.005	3.7	0.1		--	626.2	--	70	--
SW06A-2007	<	0.1	14	0.007	0.5	0.2		--	144.9	--	16	--
SW07-2006	<	2.4	58	0.041	2.3	1	<	2.6	429.2	0.01	48	0.1
SW07-2007	<	0.1	63	0.002	2.4	0.04		--	456.3	--	51	--
SW08-2006	<	2.4	102	0.024	4.0	0.6	<	2.6	667.5	0.004	74	0.04
SW08-2007	<	0.1	71	0.001	2.8	0.04		--	503.6	--	56	--
WER-1-10	<	0.1	179	0.001	7.0	0.01		--	1042.9	--	116	--
WER-1-9	<	0.1	55	0.002	2.1	0.0		--	412.4	--	46	--
WER-2-9	B	0.2	55	0.004	2.1	0.1		--	410.4	--	46	--
WER-MC-1	<	0.1	69	0.001	2.7	0.0		--	489.2	--	54	--
Rustler Canyon												
STS-CA-2010-001		0.2	46	0.004	1.8	0.1		--	358.8	--	40	--
SW05-2006	B	3.0	243	0.012	9.5	0.3		39.0	1336.3	0.03	148	0.3
SW05-2007		0.3	257	0.001	10.0	0.03		--	1400.1	--	156	--
SW06-2006	B	1.7	24	0.071	0.9	**2**	<	1.9	218.7	0.01	24	0.1
SW09-2006	<	2.4	86	0.028	3.3	0.7	<	2.6	583.2	0.004	65	0.0
SW09-2007	<	0.1	78	0.001	3.1	0.03		--	542.5		60	--
SW-10-2006	<	2.4	57	0.042	2.2	1	<	2.6	422.9	0.01	47	0.1
SW10-2007	<	0.1	47	0.002	1.8	0.1		--	362.9		40	--
SW-210-2006	<	2.4	57	0.042	2.2	1	<	2.6	425.8	0.01	47	0.1
WER-1-12	<	0.1	47	0.002	1.8	0.1		--	362.9	--	40	--
WER-1-RCS1	<	0.1	27	0.004	1.0	0.1		--	236.2	--	26	--
WER-1-RCS2	<	0.1	24	0.004	0.9	0.1		--	216.7	--	24	--
WER-1-RCS3	<	0.1	42	0.002	1.6	0.1		--	333.7	--	37	--
WER-2-12	B	0.2	43	0.005	1.7	0.1		--	342.1	--	38	--
Sub-Watershed C												
C-1 Drainage (upgradient of Bolton Canyon Confluence)												
STS-WS-2010-C-3		0.2	34.9	0.006	1.4	0.1		--	291	--	32	--
WER-1-6	B	0.4	33.1	0.012	1.3	0.3		--	279	--	31	--
WER-2-6	<	0.1	28.2	0.004	1.1	0.1		--	247	--	27	--
2013-SW-WER-6		0.1	17.1	0.006	0.7	0.2		--	169	--	19	--
2013-SW-C-BS		0.1	28.2	0.004	1.1	0.1		--	247	--	27	--
2013-SW-C-BS-D		0.2	24.2	0.008	0.9	0.2		--	220	--	24	--
2013-SW-C-BC	<	0.1	16.4	0.006	0.6	0.2		--	164	--	18	--
C-2 Drainage of Sub-Watershed C (upstream from confluence and in CLF critical habitat)												
2013-SW-C2-Lower		0.2	6.0	0.03	4.3	0.0		--	238	--	26	--
2013-SW-C2-Upper	<	0.1	6.3	0.016	4.5	0.0		--	252	--	28	--

Stream Location	Silver Q	Dissolved Ag (μg/L)	Acute Criteria (μg/L)	Acute Hardness-based HQ	Chronic Criteria (μg/L)	Zinc Q	Dissolved Zn (μg/L)	Acute Criteria (μg/L)	Acute Hardness-based HQ	Chronic Criteria (μg/L)	Chronic Hardness-based HQ
Lucky Bill Canyon											
WER-1-2		--	2.2	--	NA		3.0	132	0.02	100	100
WER-1-1		--	2.7	--	NA		3.0	147	0.02	111	0.03
WER-2-1		--	3.0	--	NA		2.0	155	0.01	118	0.02
STS-CA-2010-004		--	2.8	--	NA		3.0	150	0.02	113	0.03
SW01-2007		--	0.8	--	NA		--	79	--	60	--
SW02-2007		--	1.5	--	NA		--	105	--	80	--
SW03-2007		--	2.9	--	NA		--	153	--	116	--
SW01-2006	<	0.8	1.7	0.5	NA		0.4	114	0.004	86	0.00
SW02-2006	<	0.8	16.1	0.05	NA	B	1.5	375	0.004	284	0.01
SW03-2006	<	0.8	12.7	0.1	NA		30.7	331	0.1	251	0.1
Martin Canyon											
STS-CA-2010-008		--	5.7	--	NA		23.0	216	0.1	163	0.1
STS-WS-2010-MC		--	5.8	--	NA		38.0	219	0.2	166	0.2
SW06A-2007		--	0.3	--	NA		--	45	--	34	--
SW07-2006	<	1.6	2.7	0.6	NA	<	2.1	146	0.01	110	0.02
SW07-2007		--	3.1	--	NA		--	156	--	118	--
SW08-2006	<	1.6	6.6	0.2	NA	<	2.1	234	0.01	177	0.01
SW08-2007		--	3.7	--	NA		--	173	--	131	--
WER-1-10		--	16.4	--	NA		3.0	378	0.01	287	0.01
WER-1-9		--	2.5	--	NA		3.0	140	0.02	106	0.03
WER-2-9		--	2.5	--	NA		2.0	139	0.01	105	0.02
WER-MC-1		--	3.5	--	NA		2.0	168	0.01	127	0.02
Rustler Canyon											
STS-CA-2010-001		--	1.9	--	NA		18.0	120	0.1	91	0.2
SW05-2006	<	0.8	27.1	0.0	NA		110.0	494	0.2	374	0.3
SW05-2007		--	29.8	--	NA		--	519	--	393	--
SW06-2006	<	0.8	0.7	1	NA	<	0.4	71	0.01	53	0.01
SW09-2006	<	1.6	5.0	0.3	NA	<	2.1	203	0.01	153	0.01
SW09-2007		--	4.3	--	NA		--	187	--	142	--
SW-10-2006	<	1.6	2.6	0.6	NA	<	2.1	143	0.01	109	0.02
SW10-2007		--	1.9	--	NA		--	122	--	92	--
SW-210-2006	<	1.6	2.7	0.6	NA	<	2.1	144	0.01	109	0.02
WER-1-12		--	1.9	--	NA		3.0	122	0.02	92	0.03
WER-1-RCS1		--	0.8	--	NA	<	2.0	77	0.03	58	0.03
WER-1-RCS2		--	0.7	--	NA	<	2.0	70	0.03	53	0.04
WER-1-RCS3		--	1.6	--	NA		2.0	111	0.02	84	0.02
WER-2-12		--	1.7	--	NA		4.0	114	0.04	86	0.05
Sub-Watershed C											
C-1 Drainage (upgradient of Bolton Canyon Confluence)											
STS-WS-2010-C-3		--	1.2	--	NA		6.0	96	0.1	73	0.1
WER-1-6		--	1.1	--	NA		4.0	92	0.04	69	0.1
WER-2-6		--	0.9	--	0.0		3.0	81	0.04	61	0.0
2013-SW-WER-6		--	0.4	--			15.0	54	0.3	41	0.4
2013-SW-C-BS		--	0.9	--			2.0	81	0.0	61	0.03
2013-SW-C-BS-D		--	0.7	--			4.0	71	0.1	54	0.1
2013-SW-C-BC		--	0.4	--		<	2.0	52	0.0	39	0.1
C-2 Drainage of Sub-Watershed C (upstream from confluence and in CLF critical habitat)											
2013-SW-C2-Lower		--	0.8	--	#N/A		2.0	77	0.03	59	0.0
2013-SW-C2-Upper		--	0.9	--	#N/A		4.0	82	0.05	62	0.1

Notes:
if outside that range, dissolved Al is compared to 750 μg/L for acute criteria and 87 μg/L for chronic criteria. Dissolved is reported if outside the pH range, and total is inside the range, unless total Aluminum is unavailable.
* = pH outside of =6.5 to 9 range and therefore Aluminum is reported as dissolved. If pH unknown, assumed to be average for reach when selecting criteria for comparison
Q = qualifier, if non-detect (<), method detection limit shown
Bold = HQ > 1. If italicized bold and gray, the HQ is based on non-detect value and is unreliable
Calculation equations to adjust for hardness are shown below:

Acute and Chronic Calculations for Hardness-Dependent			
Acute (μg/L)			
Metal	**m_A**	**b_A**	**Conversion factor (CF)**
Aluminum (Al)	1.37	1.8308	
Cadmium (Cd)	0.979	-3.866	1.136672-[(ln hardness)(0.041838)]
Copper (Cu)	0.942	-1.7	0.96
Lead (Pb)	1.273	-1.46	1.46203-[(ln hardness)(0.145712)]
Nickel (Ni)	0.846	2.255	0.998
Silver (Ag)	1.72	-6.59	0.85
Zinc (Zn)	0.909	0.9095	0.978
Chronic			
Metal	**m_C**	**b_C**	**Conversion factor (CF)**
Aluminum (Al)	1.37	0.9161	
Cadmium (Cd)	0.798	-3.909	1.101672-[(ln hardness)(0.041838)]
Chromium (Cr) III	0.819	0.6848	0.86
Copper (Cu)	0.855	-1.702	0.96
Lead (Pb)	1.273	-4.705	1.46203-[(ln hardness)(0.145712)]
Manganese (Mn)	0.333	5.8743	
Nickel (Ni)	0.846	0.0584	0.997
Zinc (Zn)	0.909	0.6235	0.986
Criteria (μg/L) = exp(mA [ln(hardness)] + bA)(CF)			

TABLE 4-3
STOCK TANK CRITERIA EVALUATION FOR METALS

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILING SOILS IU FEASIBILITY STUDY

Stock Tank Location	Stock Tank ID #	Year	Hardness (mg/L)	pH	Aluminum Q	Aluminum Acute Hardness-based HQ	Aluminum Chronic Criteria (µg/L)	Aluminum Chronic Hardness-based HQ	Cadmium Q	Dissolved Cd (µg/L)	Cadmium Acute Criteria (µg/L)	Cadmium Acute Hardness-based HQ	Cadmium Chronic Criteria (µg/L)	Cadmium Chronic Hardness-based HQ	Lead Q	Dissolved Pb (µg/L)	Lead Acute Criteria (µg/L)	Lead Acute Hardness-based HQ	Lead Chronic Criteria (µg/L)	Lead Chronic Hardness-based HQ
Sub Drainage A																				
STS-CA-2010-006	T15[1]	2010	37	7.8		0.1	351	0.2		0.1	0.7	0.1	0.3	0.3		0.3	21.6	0.0	0.8	0.4
SW-4-2004	T16	2004	46	7.7		g (WBT) adjustme	475	**66**	<	0.1	0.9	0.1	0.4	0.2	<	1.8	27.5	0.1	1.1	2
SW-13-2006	T16	2006	48	7.5		**22**	508	**55**	<	0.2	0.9	0.2	0.4	0.5	<	2.4	29.1	0.1	1.1	2
SW13-2007	T16	2007	74	7.3			907	**24**	<	0.1	1.4	0.1	0.6	0.2	<	0.1	46.5	0.0	1.8	0.1
STS-WS-2010-A1	T16	2010	114	8.1			87	**99**		0.1	2.0	0.0	0.8	0.1		0.2	74.5	0.0	2.9	0.1
Stock Tank ERA41	T25	2000	43	--			431	--	<	1.5	0.8	2	0.4	4	<	20.0	25.5	0.8	1.0	20
SW-1-2004	T25	2004	70	7.9			843	**13**	<	0.1	1.3	0.1	0.6	0.2	<	1.8	43.8	0.0	1.7	1
SW-12-2006	T25	2006	37	7.4			352	**39**	<	0.2	0.7	0.3	0.3	0.6	<	2.4	21.6	0.1	0.8	2.9
SW12-2007	T25	2007	54	7.3			589	**17**	<	0.1	1.0	0.1	0.5	0.2		0.3	32.8	0.0	1.3	0.2
STS-WS-2010-A3	T25	2010	78	7.4			975	**18**		0.1	1.4	0.1	0.6	0.2		0.1	49.2	0.0	1.9	0.1
Stock Tank ERA40	T26[1]	2000	45	--			452	--	<	1.5	0.8	2	0.4	**3.8**	<	20.0	26.5	0.8	1.0	19
SW-2-2004	T26[1]	2004	62	8.0			715	**15**	<	0.1	1.2	0.1	0.5	0.2	<	1.8	38.4	0.0	1.5	*1*
SW-11-2006	T26[1]	2006	41	7.6			410	**20**	<	0.2	0.8	0.3	0.4	0.5	<	2.4	24.5	0.1	1.0	2.5
SW11-2007	T26[1]	2007	42	7.2			418	**48**	<	0.1	0.8	0.1	0.4	0.3		0.1	24.8	0.0	1.0	0.1
SW-3-2004	T60[1]	2004	25	7.5			206	**3**	<	0.1	0.5	0.2	0.3	0.4	<	1.8	13.9	0.1	0.5	3
SW-14-2006	T60[1]	2006	27	6.6			230	**9**	B	0.4	0.5	0.7	0.3	1	B	3.7	15.2	0.2	0.6	**6**
SW14-2007	T60[1]	2007	26	9.21*			87	**3**	<	0.1	0.5	0.2	0.3	0.4		0.3	14.5	0.0	0.6	0.5
Sub Drainage B																				
Stock Tank ERA39	T34	2000	192	--			3348	--	<	1.5	3.3	0.5	1.2	*1*	<	20.0	130.4	0.2	5.1	3.9
SW-5-2004	T34	2004	47	7.6			481	**41**	<	0.1	0.9	0.1	0.4	0.2	<	1.8	27.9	0.1	1.1	1.7
SW15-2006	T34	2006	46	5.56*			87	0.1	B	0.3	0.9	0.4	0.4	0.8	B	2.0	27.7	0.1	1.1	**2**
SW15-2007	T34	2007	57	7.9			635	**7**	<	0.1	1.1	0.1	0.5	0.2		0.2	34.8	0.0	1.4	0.1
STS-WS-2010-B-2	T34	2010	145	--			2280	**2**		0.1	2.5	0.0	0.9	0.1		0.5	96.5	0.0	3.8	0.1
Sub Drainage C																				
STS-WS-2010-C-4	T29[1]	2010	21	7.7			162	1		0.1	0.4	0.2	0.2	0.5		0.2	11.4	0.0	0.4	0.5
Sub Drainage D																				
STS-WS-2010-D1-3	T53	2010	61	--			696	**27**		0.1	1.1	0.1	0.5	0.2		0.4	37.6	0.0	1.5	0.3
ST-D12-2	T53	2011	56	7.7			627	--	<	0.1	1.1	0.1	0.5	0.2	B	0.3	34.5	0.0	1.3	0.2
STS-WS-2010-D1-1	P54	2010	76	6.6			941	0.1		0.1	1.4	0.1	0.6	0.2		0.3	47.8	0.0	1.9	0.2
Sub Drainage G																				
ST-G8	T36	2011	94	--			87	--	--	--	1.7	--	0.7	--	--	--	60.5	--	2.4	--
ST-G8-2	T36	2011	122	9.6*			87	0.1	<	0.1	2.2	0.0	0.8	0.1	<	0.1	80.0	0.0	3.1	0.0
Sub Drainage E																				
SW-6-2004	T06	2004	96	8.9			1290	1	<	0.1	1.7	0.1	0.7	0.1	<	1.8	61.5	0.0	2.4	0.8
SW04-2006	T06	2006	54	7.0			588	**18**	<	0.3	1.0	0.3	0.5	0.7	B	2.0	32.8	0.1	1.3	**1.6**
SW04-2007	T06	2007	83	9.05*			87	1	<	0.1	1.5	0.1	0.6	0.2		0.2	52.7	0.0	2.1	0.1
ST-E-2	T06	2011	55	8.3			599	**28**	<	0.1	1.0	0.1	0.5	0.2	<	0.1	33.2	0.0	1.3	0.1

Stock Tank Location	Nickel Q	Dissolved Ni (µg/L)	Nickel Acute Criteria (µg/L)	Nickel Acute Hardness-based HQ	Nickel Chronic Criteria (µg/L)	Nickel Chronic Hardness-based HQ	Silver Q	Dissolved Ag (µg/L)	Silver Acute Criteria (µg/L)	Silver Acute Hardness-based HQ	Zinc Q	Dissolved Zn (µg/L)	Zinc Acute Criteria (µg/L)	Zinc Acute Hardness-based HQ	Zinc Chronic Criteria (µg/L)	Zinc Chronic Hardness-based HQ
Sub Drainage A																
STS-CA-2010-006		--	202	--	22	--		--	0.6	--		5.0	65	65	49	0.1
SW-4-2004	<	1.7	243	0.01	27	0.1		0.5	0.8	0.6		1.7	79	0.02	60	0.03
SW-13-2006	<	2.6	254	0.01	28	0.1	<	1.6	0.9	2	<	2.1	83	0.03	63	0.03
SW13-2007		--	363	--	40	--		--	1.9	--		--	122	--	92	--
STS-WS-2010-A1		--	523	--	58	--		--	4.0	--		8.0	180	0.04	137	0.1
Stock Tank ERA41	<	5.0	229	0.02	25	0.2		--	0.8	--	<	5.0	74	0.1	56	0.1
SW-1-2004	<	1.7	347	0.005	39	0.04		0.5	1.7	0.3		2.0	116	0.02	88	0.02
SW-12-2006	<	2.6	202	0.01	22	0.1	<	1.6	0.6	3	<	2.1	65	0.03	49	0.04
SW12-2007		--	278	--	31	--		--	1.1	--		--	91	--	69	--
STS-WS-2010-A3		--	379	--	42	--		--	2.1	--		7.0	128	0.1	97	0.1
Stock Tank ERA40	<	5.0	236	0.02	26	0.2		--	0.8	--	<	5.0	77	0.1	58	0.1
SW-2-2004	<	1.7	313	0.01	35	0.05		0.5	1.4	0.4		2.9	104	0.03	79	0.04
SW-11-2006	<	2.6	222	0.01	25	0.1	<	1.6	0.7	2	<	2.1	72	0.03	54	0.04
SW11-2007		--	225	--	25	--		--	0.7	--		--	73	--	55	--
SW-3-2004	<	1.7	145	0.01	16	0.1		0.4	0.3	1		1.8	45	0.04	34	0.1
SW-14-2006	B	3.2	156	0.02	17	0.2	<	0.8	0.3	2	B	2.4	49	0.05	37	0.1
SW14-2007		--	150	--	17	--		--	0.3	--		--	47	--	36	--
Sub Drainage B																
Stock Tank ERA39	<	5.0	813	0.01	90	0.1		--	9.9	--	<	5.0	290	0.02	219	0.02
SW-5-2004	<	1.7	245	0.01	27	0.1	<	0.3	0.9	0.3		2.3	80	0.03	60	0.04
SW15-2006	B	3.7	245	0.02	27	0.1	<	8.0	0.9	9	<	0.4	80	0.01	60	0.01
SW15-2007		--	291	--	32	--		--	1.2	--		--	96	--	73	--
STS-WS-2010-B-2		--	641	--	71	--		--	6.1			6.0	224	--	170	--
Sub Drainage C																
STS-WS-2010-C-4		--	125	--	14	--		--	0.2	--		15.0	39	0.4	29	0.5
Sub Drainage D																
STS-WS-2010-D1-3		--	308	--	34	--		--	1.4	--		6.0	102	0.1	77	0.1
ST-D12-2		--	289	--	32	--		--	1.2	--		--	95	--	72	--
STS-WS-2010-D1-1		--	371	--	41	--		--	2.0	--		9.0	125	0.1	94	0.1
Sub Drainage G																
ST-G8		--	445	--	49	--		--	2.9	--		--	151	--	115	--
ST-G8-2		--	553	--	61	--		--	4.5	--		--	191	--	145	--
Sub Drainage E																
SW-6-2004	<	1.7	451	0.00	50	0.03		0.6	3.0	0.2		0.7	154	0.005	116	0.01
SW04-2006	B	2.0	278	0.01	31	0.1	<	0.8	1.1	0.7	<	0.4	91	0.004	69	0.01
SW04-2007		--	400	--	44	--		--	2.3	--		--	135	--	102	--
ST-E-2		--	281	--	31	--		--	1.1	--		--	92	--	70	--

1. Stock tank was removed between 2013 and 2022 as part of ongoing rangeland improvements.

Notes:

[a]Acute & Chronic Criteria Calculated with equation 1 (acute) or 2 (chronic) of New Mexico Administrative Code (NMAC) 20.6.4.900(I), Effective February 8, 2023.However, for Aluminum, hardness-adjusted total aluminum criteria are applied to water of pH 6.5 to 9; only acute criteria are applicable to these stock tanks because drained by ephemeral streams and are not full year-round.
if outside that range, dissolved Al is compared to 750 µg/L for acute criteria and 87 µg/L for chronic criteria. Dissolved is reported if outside the pH range, and total is inside the range, unless total Aluminum is unavailable.
* = pH outside of =6.5 to 9 range and therefore Aluminum is reported as dissolved. If pH unknown, assumed to be average for reach when selecting criteria for comparison
Q = qualifier, if non-detect (<), method detection limit shown
Bold = HQ > 1. If italicized bold and gray, the HQ is based on non-detect value and not reliable
Calculation equations to adjust for hardness are shown below:

Acute and Chronic Calculations for Hardness-Dependent New Mexico Water Quality Criteria Calculations

Metal	m_A	b_A	Conversion factor (CF)
Acute (µg/L)			
Aluminum (Al)	1.37	1.831	
Cadmium (Cd)	0.979	-3.866	1.136672-[(ln hardness)(0.041838)]
Copper (Cu)	0.942	-1.7	0.96
Lead (Pb)	1.273	-1.46	1.46203-[(ln hardness)(0.145712)]
Nickel (Ni)	0.846	2.255	0.998
Silver (Ag)	1.72	-6.59	0.85
Zinc (Zn)	0.909	0.91	0.978
Chronic			
Metal	m_C	b_C	**Conversion factor (CF)**
Aluminum (Al)	1.37	0.916	
Cadmium (Cd)	0.798	-3.909	1.101672-[(ln hardness)(0.041838)]
Copper (Cu)	0.855	-1.702	0.96
Lead (Pb)	1.273	-4.705	1.46203-[(ln hardness)(0.145712)]
Nickel (Ni)	0.846	0.058	0.997
Zinc (Zn)	0.909	0.624	0.986
Criteria (µg/L) = exp(mA [ln(hardness)] + bA)(CF)			

TABLE 4-4
WATER-EFFECT RATIOS (WER) USED TO EVALUATE THE NATURE AND EXTENT OF COPPER CONTAMINATION

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILING SOILS IU FEASIBILITY STUDY

Sample ID	Sub-Watershed	Water effect ratio (WER)
Round 1 Samples		
WER 1-1	Lucky Bill	6.651
WER 1-2	Lucky Bill	5.334
WER 1-5[a]	Lower C-1 Drainage	--
WER 1-6	Upper C-1 Drainage	14.407
WER 1-7	B Drainage	4.717
WER 1-9	Martin Canyon	2.207
WER 1-10	Martin Canyon	2.804
WER 1-11	G-drainage	5.956
WER 1-12	Rustler Canyon	0.989
WER 1-RCS	Rustler Canyon	3.273
WER D1-2	D-1 Drainage	13.104
WER D2-1b	D-2 Drainage	8.027
Round 2 Samples		
WER 2-1	Lucky Bill	4.046
WER 2-6	Upper C-1 Drainage	6.151
WER 2-9	Martin Canyon	11.530
WER 2-11	G-drainage	6.889
WER 2-12	Rustler Canyon	2.251
WER 2-D12	D-1 Drainage	5.724
	Geometric mean all STSIU WERs =	**5.003**

Notes:

a. WER not derived based on results of toxicity test and WER guidance.

TABLE 4-5
SURFACE WATER CRITERIA EVALUATION FOR DISSOLVED COPPER - EPHEMERAL WATERSHEDS

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILING SOILS IU FEASIBILITY STUDY

Stream Location	Year	Hardness (mg/L)	Dissolved Cu (µg/L)	Acute Hardness-based Criterion (µg/L)	Acute Hardness-based HQ	Watershed-specific WER-based Acute HQ[1]	IU-based WER-based Acute HQ[2]
Lampbright Draw Watershed							
Lampbright Draw							
ERA 25	2000	187	15.0	24.2	0.6	WBT) adjustm	0.1
ERA 45	2000	202	10.8	26.1	0.4	0.1	0.1
SW-10-2006	2006	89	4.1	12.0	0.34		0.1
Sub-Watershed A							
A-Drainage							
STS-WS-2010-A2	2010	32	73.9	4.6	**16**		**3**
STS-WS-2010-A4	2010	30	25.0	4.3	**6**		**1**
Sub-Watershed B							
B-Drainage							
WER-1-7	2011	108	43.0	14.4	**3**		0.6
STS-WS-2010-B-3	2010	111	35.8	14.8	**2**		0.5
2013-SW-B-AS	2013	233	44.7	29.8	**1**		0.3
2013-SW-WER-7	2013	78	40.0	10.6	**4**		0.8
Sub-Watershed C (non-headwaters)							
C-1 Drainage (downgradient of Bolton Canyon Confluence)							
STS-WS-2010-C-1	2010	62	34.8	8.6	**4**		0.8
STS-WS-2010-C-2	2010	53	36.6	7.4	**5**		1.0
WER-1-5	2011	64	32.3	8.8	**4**		0.7
BD4W-1-2004	2004	68	207.0	9.3	**22**		**4**
BD4W-1-2007	2007	70	80.0	9.6	**8**		**2**
2013-SW-WER-5	2013	63	33.6	8.7	**4**		0.8
C-2 Drainage (downgradient from confluence with CLF critical habitat)							
ERA37	2000	103	64.8	13.8	**5**		0.9
ERA38	2000	94	150.0	12.7	**12**		**2**
WER-1-BD	2011	66	94.1	9.1	**10**		**2**
2013-SW-WER-BD	2013	35	80.6	5.0	**16**		**3**
2013-SW-C2-Lower	2013	45	38.3	6.3	**6**		**1**
Sub-Watershed D							
D-1 Drainage							
WER-1-D1-2	2011	52	32.3	7.3	**4**		0.9
WER-1-D1	2011	27	21.1	3.9	**5**		**1**
WER-2-D1-2	2011	57	17.9	7.9	**2**		0.5
STS-WS-2010-D1-2	2010	56	25.0	7.8	**3**		0.6
2013-SW-WERDI-2	2013	44	41.0	6.2	**7**		**1**
D-2 Drainage							
WER-1-D2-1	2011	44	32.8	6.2	**5**		**1**
WER-D2-2	2011	55	18.8	7.7	**2**		0.5
STS-WS-2010-D2-1	2010	47	20.0	6.6	**3**		0.6
2013-SW-D2	2013	22	60.8	3.2	**19**		**4**
D-3 Drainage							
CDW-1-2004	2004	53	327.0	7.4	**44**		**9**
CDW-1-2007	2007	35	221.0	5.0	**44**		**9**
CDW-1-2013	2013	37	208.1	5.3	**40**		**8**
Sub-Watershed G							
G-Drainage							
WER-1-11	2011	164	4.3	21.4	0.2		0.0
WER-2-11	2011	119	7.9	15.8	0.5		0.1

Notes:

1. HQs adjusted using the WER determined in the sample's watershed, or nearest watershed (e.g., Subwatershed A used Subwatershed
where multiple WERs were determined in a single watershed, the geometric mean of these WERs was calculated and used as a watersh
A summary of watershed-specific WERs is provided below:

Sub-watershed B	4.717
Sub-watershed C	9.414
Sub-watershed D-1	8.661
Sub-watershed D-2	8.027
Sub-watershed G	6.406

2. HQs adjusted using the STSIU geometric mean WER (5.003) presented in Table 4-4.

TABLE 4-6
SURFACE WATER CRITERIA EVALUATION FOR DISSOLVED COPPER - NON-EPHEMERAL WATERSHEDS

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILING SOILS IU FEASIBILITY STUDY

Stream Location	Year	Hardness (mg/L)	Dissolved Cu (µg/L)	Acute Hardness-based Criterion (µg/L)	Acute Hardness-based HQ	Watershed-specific WER-based Chronic HQ[1]	IU-based WER-based Chronic HQ[2]
Lucky Bill Canyon							
WER-1-2	2011	81	6.5	11.01	0.59	0.17	0.17
WER-1-1	2011	91	5.9	12.29	0.48	0.14	0.14
WER-2-1	2011	97	3.4	13.03	0.26	WBT) adjustm	0.08
STS-CA-2010-004	2010	93	3.3	12.55	0.26	0.07	0.08
SW01-2007	2007	46	19.3	6.47	3		0.84
SW02-2007	2007	63	13.9	8.70	2		0.46
SW03-2007	2007	95	14.5	12.81	1		0.34
SW01-2006	2006	69	15.3	9.52	2		0.47
SW02-2006	2006	255	5	32.50	0.15		0.05
SW03-2006	2006	223	20.9	28.57	0.73		0.24
Martin Canyon							
STS-CA-2010-008	2010	139	13.1	18.33	0.71		0.22
STS-WS-2010-MC	2010	141	14.1	18.58	0.76		0.23
SW06A-2007	2007	25	30.1	3.64	8		2
SW07-2006	2006	90	15.1	12.20	1		0.37
SW07-2007	2007	97	8.1	13.06	0.62		0.19
SW08-2006	2006	152	5	19.95	0.25		0.08
SW08-2007	2007	109	4.7	14.58	0.32		0.10
WER-1-10	2011	258	5.4	32.79	0.16		0.05
WER-1-9	2011	86	7.1	11.67	0.61		0.18
WER-2-9	2011	86	13.7	11.60	1		0.35
WER-MC-1	2011	105	8.1	14.11	0.57		0.17
Rustler Canyon							
STS-CA-2010-001	2010	73	2.7	9.99	0.27		0.08
SW05-2006	2006	345	55	43.21	1		0.43
SW05-2007	2007	365	1220	45.52	27		9
SW06-2006	2006	41	19.7	5.76	3		0.95
SW09-2006	2006	130	9.1	17.16	0.53		0.16
SW09-2007	2007	119	11	15.83	0.69		0.21
SW10-2007	2007	74	2.6	10.12	0.26		0.08
SW-210-2006	2006	89	2.5	12.09	0.21		0.06
WER-1-12	2011	74	2.1	10.12	0.21		0.06
WER-1-RCS1	2011	45	5	6.27	0.80		0.22
WER-1-RCS2	2011	40	5.3	5.70	0.93		0.26
WER-1-RCS3	2011	67	2.2	9.21	0.24		0.07
WER-2-12	2011	69	3.6	9.42	0.38		0.11
Headwaters of Sub-Watershed C in Drainage C-1 (upgradient of Bolton Canyon confluence)							
STS-WS-2010-C-3	2010	57	23.4	7.9	3		0.8
WER-1-6	2011	54	57.4	7.5	8		2
WER-2-6	2011	47	30.2	6.6	5		1
2013-SW-WER-6	2013	30	72.3	4.3	17		5
2013-SW-C-BS	2013	47	48.2	6.6	7		2
2013-SW-C-BS-D	2013	41	61.8	5.8	11		3
2013-SW-C-BC	2013	29	28.3	4.2	7		2
C-2 Drainage of Sub-Watershed C (upstream from confluence and in CLF critical habitat)							
2013-SW-C2-Lower	2013	45	38.3	6.3	6		2
2013-SW-C2-Upper	2013	48	33.6	6.7	5		1

Notes:
1. HQs adjusted using the WER determined in the sample's watershed, or nearest watershed. In cases where multiple local WERs were determ
the geometric mean of these WERs was calculated and used as a watershed-specific WER. A summary of watershed-specific WERs is provi

Lucky Bill Canyon	5.236
Martin Canyon	4.148
Rustler Canyon	1.939
Sub-watershed C	9.414

2. HQs adjusted using the STSIU geometric mean WER (5.003) presented in Table 4-4.

TABLE 4-7
STOCK TANK SURFACE WATER CRITERIA EVALUATION FOR DISSOLVED COPPER

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILING SOILS IU FEASIBILITY STUDY

Stock Tank Location	Stock Tank ID #	Year	Hardness (mg/L)	Dissolved Cu (µg/L)	Acute Hardness-based Criteria (µg/L)	Chronic Hardness-based HQ	Watershed-specific WER-Adjusted Acute HQ[1]	IU-based WER-Adjusted Acute HQ[2]
Sub Drainage A								
STS-CA-2010-006	T15[3]	2010	37	47.0	5.27	12.27	2	2
							2	2
SW-4-2004	T16	2004	46	37.1	6.48	WBT) adjustm	1	1
SW-13-2006	T16	2006	48	49.5	6.79	10	2	1
SW13-2007	T16	2007	74	45.6	10.12		0.96	0.90
STS-WS-2010-A1	T16	2010	114	33.1	15.20		0.46	0.44
T16 Stock Tank	T16	2021	98	37.5	13.19		0.60	0.57
							0.95	0.82
Stock Tank ERA41	T25	2000	43	28.6	6.07		1.00	0.94
SW-1-2004	T25	2004	70	43.6	9.62		0.96	0.91
SW-12-2006	T25	2006	37	51.4	5.28		2	2
SW12-2007	T25	2007	54	45.8	7.52		1	1
STS-WS-2010-A3	T25	2010	78	40.8	10.63		0.81	0.77
							1	1
Stock Tank ERA40	T26[3]	2000	45	25.6	6.27		0.87	0.82
SW-2-2004	T26[3]	2004	62	51.4	8.59		1	1
SW-11-2006	T26[3]	2006	41	48.7	5.86		2	2
SW11-2007	T26[3]	2007	42	39.7	5.93		1	1
							1	1
SW-3-2004	T60[3]	2004	25	38.0	3.65		2	2
SW-14-2006	T60[3]	2006	27	51.8	3.94		3	3
SW14-2007	T60[3]	2007	26	48.7	3.78		3	3
							3	2
Sub Drainage B								
Stock Tank ERA39	T34	2000	192	28.0	24.85		0.24	0.23
SW-5-2004	T34	2004	47	60.6	6.54		2	2
SW15-2006	T34	2006	46	72.1	6.52		2	2
SW15-2007	T34	2007	57	52.2	7.91		1	1
STS-WS-2010-B-2	T34	2010	145	73.9	19.07		0.82	0.77
							1	0.99
Sub Drainage C								
STS-WS-2010-C-4	T29[3]	2010	21	53.1	3.09		2	3
							2	3
Sub Drainage D								
STS-WS-2010-D1-3	T53	2010	61	33.6	8.44		0.46	0.80
ST-D12-2	T53	2011	56	44.1	7.78		0.65	1
							0.55	0.95
STS-WS-2010-D1-1	T54	2010	76	13.0	10.38		0.14	0.25
							0.14	0.25
Sub Drainage G								
ST-G8	T36	2011	94	--	12.68		--	--
ST-G8-2	T36	2011	122	2.3	16.21		0.02	0.03
							0.02	0.03
Sub Drainage E								
SW-6-2004	T06	2004	96	95	12.89		--	1
SW04-2006	T06	2006	54	220	7.51		--	6
SW04-2007	T06	2007	83	129	11.28		--	2
ST-E-2	T06	2011	55	79	7.60		--	2
T06 Stock Tank	T06	2021	139	113	18.33		--	1
T06 Stock Tank	T06	2022	90	142	12.17		--	2
							--	2

Notes:
1. HQs adjusted using the WER determined in the sample's watershed, or nearest watershed. In cases where multiple WERs were determined in a s
the geometric mean of these WERs was calculated and used as a watershed-specific WER. A summary of watershed-specific WERs is provided l
2. HQs adjusted using the STSIU geometric mean WER (5.003) presented in Table 4-4.

Sub-watershed B	4.717
Sub-watershed C	9.414
Sub-watershed D-1	8.661
Sub-watershed D-2	8.027
Sub-watershed G	6.406

3. Stock tank was removed between 2013 and 2022 as part of ongoing rangeland improvements.

TABLE 5-1
SOIL REMEDIAL TECHNOLOGIES

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILING SOILS IU FEASIBILITY STUDY

NO.	REMEDIAL TECHNOLOGY	DESCRIPTION	PRELIMINARY SCREENING			CONCLUSION
			EFFECTIVENESS	IMPLEMENTABILITY	COST	
1	No Action	No further active response actions.	Contaminants will naturally attenuate over time. Does not provide additional mechanisms to prevent contaminant exposure to site receptors.	Is considered implementable.	There are no costs associated with no action.	Being retained for baseline comparison of remedial technologies.
2	Monitoring	No further active response actions. Monitoring will be conducted to prove the occurrence of natural remediation.	Contaminants will naturally attenuate over time. Does not provide additional mechanisms to prevent contaminant exposure to site receptors.	Is considered implementable.	Costs are associated with types of monitoring (quantitative and/or qualitative) and monitoring duration selected.	Being retained for evaluation and as part of a remedial alternative.
3	Excavation					
3	Excavation and Reuse	Excavation and onsite management includes removal of contaminated soils with heavy construction equipment and hand removal techniques. Excavated soils will be managed onsite at the waste rock stockpiles or reused in the adjacent operational areas as cover for the tailings ponds.	Is considered highly effective at reducing the presence of site contaminants.	Is considered to be generally technically implementable with the exception of certain areas of the site that are more difficult to access with equipment and personnel due to terrain conditions.	Costs include equipment use and maintenance, material handling and transport, and backfill materials and activities. Costs are considered less than Excavation and Disposal option because offsite transportation and disposal is not needed. Long term O&M costs are considered to be low.	Being retained for evaluation as a part of a remedial alternative.
3a	Excavation and Disposal	Excavation and disposal includes removal of contaminated soils with heavy construction equipment and hand removal techniques. Excavated soils will be characterized to determine final offsite disposition.	Is considered highly effective at reducing the presence of site contaminants.	Excavation is considered to be generally technically implementable with the exception of certain areas of the site that are more difficult to access with equipment and personnel due to terrain conditions. Offsite transportation to a permitted facility that could accept the soils is not considered to be economical. Therefore the offsite transportation and disposal is considered to have low implementability.	Costs include equipment use and maintenance, material handling and transport, backfill materials and activities, characterization, and offsite transportation and disposal. Long term O&M costs are considered to be low.	Being retained for evaluation as a part of a remedial alternative.
4	Soil Amendments					
4a	Limestone and Organic Matter	5-Year amendment study tested combinations of lime slurry and organic matter, and tilling applications. Plant coverage, pH, and soil chemistry were monitored. Plant coverage, pH, and soil chemistry would be monitored post-amendment operations.	After the white rain already improved many areas on the site, liming may not improve a plant community or reduce uptake into plants unless pH < 2. Organic matter amendments did not improve the plant community and contributed to proliferation of weeds toxic to wildlife. Plant communities on steep slopes > 13% were degraded by the amendments.	This technology has been demonstrated to be implementable via the ongoing amendment study. This technology may be less implementable at certain areas of the site that are not readily accessible by equipment.	Costs are moderate and include purchase and transport of amendments to the site, and equipment for application. Minimal soil handling is required as soils generally remain in place, minimizing transportation and disposal costs. Long term O&M costs are considered low to moderate.	Being retained for evaluation as a part of a remedial alternative.
4b	Tilling or Ripping	5-Year amendment study tested combinations of lime slurry and organic matter, and tilling applications. Plant coverage, pH, and soil chemistry were monitored. Tilling de-compacts soil and provides additional dilution of metals and has potential to raise alkaline pH conditions to more neutral pH conditions pending existing pH levels within the soil treatment area being tilled. Plant coverage, pH, and soil chemistry would be monitored post-tilling operations.	Tilling is most effective in compacted soils (e.g., flat rocky habitats). Is potentially effective at raising alkaline pH conditions and making contaminants less bioavailable to site receptors without the introduction of lime and/or organic matter, as observed on the haul road that was ripped (discussed in Appendix A).	This technology has been demonstrated to be implementable via the 5-year amendment study. This technology may be less implementable at certain areas of the site that are not readily accessible by equipment for tilling (i.e., areas with too steep of a slope, > 13%)	Tilling includes increased efforts and costs as compared to adding lime and organic matter without tilling. However, minimal soil handling is required as soils generally remain in place, minimizing transportation and disposal costs compared to excavation and soil covers. Long term O&M costs are considered low to moderate.	Being retained for evaluation as a part of a remedial alternative.
4c	Ferrihydrite	Ferrihydrite is mixed into the impacted soils to reduce the copper bioavailability to site receptors.	Effectiveness would be determined via conducting a pilot treatability study and potentially bench scale treatability study to determine the loading rate of ferrihydrite or if other amendments such as lime or magnesium oxide (MgO) would be beneficial in buffering the pH. Because iron is being introduced to the soils, evaluations would be conducted to verify that the iron levels are acceptable from a human health and ecological perspective.	This technology is considered to be implementable, based on the ongoing soil amendment study which has demonstrated that soil mixing is feasible. A pilot treatability study would be required to determine the most effective soil mixing technique.	Cost will depend on soil mixing technique determined and market value of the amendment materials. The overall technology is considered to have moderate costs and is comparable to the costs of the lime and OM amendments being tested as part of the Amendment Study. Long term O&M are considered low to moderate.	Being retained for evaluation as a part of a remedial alternative.
4d1	Use of Chelating Agent: Soil Washing (Ex-Situ)	Ex-situ soil washing includes removal of contaminants from soil using separation methodologies, including "washing" the soils with a detergent and/or chelating agent solution. The resulting clean portions of soil can be returned to the site for reuse and the resulting wash mixture and contaminated soil fines would be characterized for final disposition.	Is potentially effective at removing copper from soil. However, level of effectiveness would have to be verified via a pilot treatability study.	A pilot treatability study would be required to determine implementability. Factors to consider to evaluate implementability include, but are not limited to, accessibility of soil washing materials (e.g., water source) and equipment to areas of remediation.	Ex-Situ soil washing is labor intensive and requires a high level of soil handling (excavation, washing, soil replacement). Requires disposal of used wash solution and potentially portions of soil. Cost savings include utilizing remediated soil for onsite reuse, reducing imported backfill required.	Not being retained for further evaluation.
4d2	Use of Chelating Agent: Soil Washing (In-Situ)	In-situ soil washing includes introducing a chelating agent into the soil. The objective of the chelating agent is to mobilize the copper within the soil column. The copper becomes soluble within the groundwater and the groundwater is subsequently extracted for treatment and/or disposal with a groundwater extraction system.	Is potentially effective at removing copper from soil. However, level of effectiveness would have to be verified via a pilot treatability study.	Due to the large areas needing remediation and lack of current infrastructure to support a groundwater extraction system, this is considered to have low implementability. However, a pilot treatability study would be required to determine implementability.	In-Situ soil washing is labor intensive and requires the introduction of the chelating agent into the soils, installation of groundwater extraction system, and extracted groundwater treatment and/or disposal. Costs for construction and future O&M activities are considered very high.	Not being retained for further evaluation.

TABLE 5-1
SOIL REMEDIAL TECHNOLOGIES

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILING SOILS IU FEASIBILITY STUDY

NO.	REMEDIAL TECHNOLOGY	DESCRIPTION	PRELIMINARY SCREENING			CONCLUSION
			EFFECTIVENESS	IMPLEMENTABILITY	COST	
4d3	Use of Chelating Agent: Phytoextraction	Phytoextraction includes the planting of specified seeds and plants to uptake the contaminants through the root system into the plant tissue. The plants are then harvested on a regular basis to remove the contaminants from the site. A chelating agent can be applied to the soil to increase the rate of contaminant uptake into the plants.	Is potentially effective at removing copper from soil. Phytoaccumulation of contaminants in seeds and vegetation has potential to directly expose site receptors to contaminants. The effectiveness of contaminant removal is directly dependent on the success of the plants and the rate of contaminant uptake.	A pilot treatability study would be required to determine implementability. Factors to evaluate implementability include, but are not limited to, types of seeds and vegetation, harvesting and replanting schedule, chelating agent, and rate of contaminant uptake.	Initial costs are considered low to moderate and include costs of seeds/plants, chelating agent, and planting. O&M is considered high due to the long term harvesting and replanting schedule, maintenance of the plants, and disposal of the plant waste. Costs are considered moderate to high as compared to other technologies.	Not being retained for further evaluation.
5	Containment					
5a	Soil Cover	A soil cover involves isolating impacted soils from potential site receptors. The soil cover would consist of clean soil and would be constructed over soils with copper levels above the site RAC to serve as a physical barrier between contaminated soils and site receptors. In addition, the cover could be constructed in areas of exposed bedrock to create pre-existing habitat for site receptors.	Is effective at protecting site receptors from underlying contaminants. Contaminants will remain onsite requiring institutional controls to restrict future intrusive activity practices. Maintenance of BMPs is considered critical to maintain the integrity and effectiveness of the soil cover.	Is considered to be generally technically implementable with the exception of certain areas of the site that are more difficult to access with equipment and personnel due to terrain conditions.	Costs are considered moderate as compared to soil excavation and the soil amendment technologies. There are higher initial costs associated with soil handling and placement of the cover. However, there are no costs associated with excavation or soil amending. O&M costs related to maintaining the cover are considered moderate.	Being retained for evaluation as a part of a remedial alternative.
5b	Impermeable Cover	An impermeable cover, such as asphalt or concrete, placed over targeted impacted soils would greatly minimize or eliminate the potential for direct contact of site receptors with impacted site soils.	An impermeable cover would be effective at reducing exposure of site receptors to impacted soils. However, an impermeable cover would eliminate the vegetative landscape, potential for future grazing, and would impact surface water infiltration and stormwater runoff patterns.	Installation of an impermeable cover is generally considered implementable with exception of areas that are too steep and/or areas with varying topography that can not be graded to conditions that could accommodate the cover.	Costs include surface preparation and grading, and installation of the impermeable cover, including base materials. Costs are considered to be moderate as compared to other soil remedial technologies. Long term O&M costs are considered low.	Not being retained for further evaluation.
6	Surface Soil Controls: Phytostabilization	Surface soil controls includes stabilizing surface soils to prevent or lower airborne dispersion of impacted soils and provide erosion control. Phytostabilization is considered a method to stabilize the surface soils through revegetation. Phytostabilization consists of revegetating the impacted areas with plant species targeted at increasing long term stabilization as compared to existing vegetative conditions.	Phytostabilization has the potential to be effective at stabilizing the soils and reducing transport of impacted soils. However, this technology used alone would not be effective at reducing site contaminant levels and/or exposure to site receptors. This could be effectively be used in conjunction with other remedial technologies.	Revegetating soils with species that are targeted at soil stabilization is generally considered implementable at the Site. There may be certain areas of the site that may not support the phytostabilization species (due to slopes, percent soil coverage, and soil conditions). Plant species and potential locations would be determined during the remedial design process.	Costs include the costs of the individual plants, planting, and limited O&M. O&M is considered moderate the first 3 to 5 years, or until the vegetation is considered to be established. O&M is considered to be low once the vegetation has been established. Costs are considered moderate compared to other technologies.	Being retained for evaluation as a part of a remedial alternative.
7	Phytoremediation	Phytoremediation consists of planting vegetation that can uptake the contaminants located in the soil and subsequently remediate the soils. Plants and/or trees would be selected that are able to bioaccumulate and/or degrade the site contaminants.	Phytoremediation is potentially effective at remediating site contaminants. Contaminant reduction would take several years to achieve and would not immediately reduce potential exposure to site receptors. A preliminary remedial design evaluation would be required to determine if the naturally existing conditions at the site (e.g., humidity, access to groundwater, soil conditions) could support phytoremediating plant species.	Assuming that the naturally occurring site conditions can support phytoremediating plant species, phytoremediation is generally considered implementable at the Site although it will take time to reduce site contaminants. There may be areas of the site that may not support the phytoremediating species (due to slopes, percent soil coverage, access to groundwater, and soil conditions) where it is not implementable.	Costs include the cost of the individual plants/trees, planting, and O&M. O&M is considered moderate to high, as remediation of the site contaminants is directly dependent on the success of the plants/trees to thrive over an extended period of time. Costs are considered moderate to high as compared to other technologies.	Not being retained for further evaluation
8	Electrokinetic Remediation	Electrokinetics is based on the principle that when direct current (DC) is passed through contaminated soil, certain (negatively charged) types of contaminants will migrate through the soil pore water to a place where they can be removed. This alternative uses electrode assemblies that are installed in the ground in a square array and connected to a DC voltage power supply. Each electrode assembly contains water, a pump, an electrode, and various controllers and sensors. The outer casing of the electrodes is made of porous ceramic through which the electrical current and contaminants pass. A vacuum is applied to the casings which keeps the water inside the assembly from flowing out and saturating adjacent soils.	Overall effectiveness of using electrokinetic remediation would need to be determined by conducting a pilot and potentially a bench scale treatability study. Factors that would be evaluated during the treatability studies would include, but would not be limited to, voltage rates, effectiveness in soils with low moisture content, and the increased acidity to the treated soil.	Electrokinetic remediation has not been tested at the site, so currently is considered low for implementability. A pilot treatability study would need to be conducted to determine if the low soil moisture content in the soil would support the removal of copper and if the increased soil acidity would impact vegetative species.	The cost associated with electokinetic remediation is assumed to be moderate to high. Factors such as the spacing and number of electrodes would be determined during a pilot treatability study and could greatly impact the costs for this technology. Therefore, without the results of a pilot study the overall cost of implementation cannot be determined.	Not being retained for further evaluation

TABLE 5-2
SURFACE WATER REMEDIAL TECHNOLOGIES

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILING SOILS IU FEASIBILITY STUDY

NO.	REMEDIAL TECHNOLOGY	DESCRIPTION	PRELIMINARY SCREENING			CONCLUSION
			EFFECTIVENESS	IMPLEMENTABILITY	COST	
1	No Action	No further active response actions for surface water.	Contaminants will naturally attenuate over time. Does not provide additional mechanisms to prevent contaminant exposure to site receptors.	Is considered implementable.	There are no costs associated with no action.	Being retained for baseline comparison of remedial technologies.
2	Monitoring	No further active response actions for surface water. Monitoring to be conducted to prove the occurrence of natural attenuation.	Contaminants will naturally attenuate over time. Does not provide additional mechanisms to prevent or reduce contaminant exposure to site receptors.	Is considered implementable.	Costs are associated with types of monitoring (quantitative and/or qualitative) and monitoring durations selected.	Being retained for evaluation as a part of a remedial alternative.
3	Excavation (In-Drainage, Upland, or Stock Ponds)	Excavation includes removing impacted in-drainage sediments and/or upland soils determined to be contributing to surface water impacts.	Is considered highly effective at reducing the presence of site contaminants.	Is considered to be generally technically implementable with the exception of certain areas of the site that are more difficult to access with equipment and personnel due to terrain conditions.	Costs include equipment use and maintenance, material handling and transport, and characterization and final disposition. Long term O&M costs related to BMPs are considered to be low to moderate.	Being retained for evaluation as a part of a remedial alternative.
4	In-Stream Removal of Suspended Sediments	Consists of construction of settling basins within the stream drainage areas to allow for sediments to descend to bottom of the pool and accumulate. Accumulated impacted sediments would be removed by mechanical methods.	Is considered to be effective at capturing contaminated sediments. Settling pools currently exist on site and have demonstrated effectiveness in capturing contaminated sediments	Is considered to be technically implementable. Some portions of drainage areas may be restricted from construction of pools due to equipment accessibility restrictions.	Costs are considered to be moderate during construction of the settling pools. Long term O&M costs are considered to be moderate to high as compared to excavation and surface water treatment.	Being retained for evaluation as a part of a remedial alternative.
5	Limestone Treatment	Consists of installation of features, such as limestone, within the surface water drainage pathway. As the surface water passes over the feature (e.g., limestone) the pH is elevated, subsequently making the contaminants (copper) less bioavailable to site receptors.	Is considered effective at raising surface water pH as long as surface water makes contact with the limestone features.	Is considered to be technically implementable. Some portions of drainage areas may be restricted from installation of limestone features due to equipment accessibility restrictions.	Costs are considered to be high during construction of the limestone features. Long term O&M costs are considered to be low compared to excavation and in-stream removal of suspended sediments.	Being retained for evaluation as a part of a remedial alternative.
6	Alkaline Washing	Consists of insertion of alkaline fluid into the sediments and banks of the drainage. The alkaline wash will raise pH and sequester metals in the sediments, subsequently reducing mobilization of the contaminants (copper) to surface water.	Is considered effective at raising pH and lowering metals concentrations in surface water as long as the majority of metals loading is coming from sediments.	Is considered to have low implementability. There are large infrastructure requirements and some portions of the drainage area may be restricted due equipment accessibility restrictions.	Costs are considered to be high both during the construction and O&M phases when compared to other remedial options.	Not being retained for evaluation as a part of a remedial alternative.
7	Sediment and Erosion Control	Consists of construction of ditches, berms, and other controls (e.g., sedimentation controls) to prevent surface water run-on to the impacted areas and run-off from the impacted areas.	Is considered effective at minimizing the transport of contaminants to and from the drainage areas and surface water.	Is considered to be technically implementable in the drainage area and upland portions of the Site with exception to areas that may be inaccessible to equipment and personnel.	Construction costs are considered to be low to moderate. Long term O&M costs associated with maintenance, repair, and replacement of controls are considered to be low to moderate compared to other surface water remedial technologies.	Being retained as a component of remedial alternatives.

TABLE 5-3
SUMMARY OF RETAINED REMEDIAL TECHNOLOGIES

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILING SOILS IU FEASIBILITY STUDY

Soils	Surface Water
No Action	No Action
Monitoring	Monitoring
Excavation and Reuse	Excavation (In-drainage, Upland, or Stock Ponds)
Excavation and Disposal	In-stream Removal of Suspended Sediments
Soil Amendments (Limestone, Organic Material)	Limestone Treatment
Soil Amendments - Tilling	Sediment and Erosion Control
Soil Amendments (Ferrihydrite)	
Soil Cover	
Surface Soil Controls - Phytostabilization	

TABLE 6-1
REMEDIAL ALTERNATIVES FOR CONSIDERATION - SOILS (TOTAL METALS)

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILING SOILS IU FEASIBILITY STUDY

MEDIA	TECHNOLOGY TYPE	ALTERNATIVES				
		1 - NO ACTION	2 - MONITORING	3 - EXCAVATION AND MONITORING	4 - SOIL COVER AND MONITORING	5 - SOIL AMENDMENTS/TILLING AND MONITORING
Upland Soils (Total Metals)	No Action	X				
	Monitoring		X	X	X	X
	Lime and/or Organic Material					X
	Tilling					X
	Soil Cover				X	

TABLE 6-2
REMEDIAL ALTERNATIVES FOR CONSIDERATION - SOILS (pCu)

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILING SOILS IU FEASIBILITY STUDY

MEDIA	TECHNOLOGY TYPE	ALTERNATIVES							
		1 - NO ACTION	2 - MONITORING	3 - EXCAVATION (REUSE OR DISPOSAL) AND MONITORING	4 - SOIL AMENDMENTS (LIME), TILLING AND MONITORING	5 - TILLING AND MONITORING	6 - SOIL AMENDMENTS (FERRIHYDRITE), TILLING AND MONITORING	7 - SOIL COVER AND MONITORING	8 - SURFACE SOIL CONTROLS - PHYTOSTABLIZATION
Upland Soils (pCu)	No Action	X							
	Monitoring		X	X	X	X	X	X	X
	Excavation and Reuse or Disposal			X					
	Soil Amendments				X		X		
	Tilling				X	X	X		
	Soil Cover								
	Phytostabilization							X	X

TABLE 6-3
REMEDIAL ALTERNATIVES FOR CONSIDERATION - SURFACE WATER DRAINAGES

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILING SOILS IU FEASIBILITY STUDY

MEDIA	TECHNOLOGY TYPE	ALTERNATIVES					
		1 - NO ACTION	2 - MONITORING	3 - EXCAVATION AND MONITORING	4 - EXCAVATION, SEDIMENT CONTROL, LIMESTONE TREATMENT, AND MONITORING	5 - LIMESTONE TREATMENT AND MONITORING	6 - SEDIMENT CONTROL, EROSION CONTROL, AND MONITORING
SURFACE WATER	No Action	X					
	Monitoring		X	X	X	X	X
	Excavation (In-drainage, Upland, or Stock Ponds)			X	X		
	In-stream Removal of Suspended Sediments				X		
	Limestone Treatment				X	X	
	Sediment and Erosion Control						X

TABLE 6-4
REMEDIAL ALTERNATIVES FOR CONSIDERATION - SURFACE WATER STOCK TANKS

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILING SOILS IU FEASIBILITY STUDY

MEDIA	TECHNOLOGY TYPE	ALTERNATIVES		
		1 - NO ACTION	2 - MONITORING	3 - EXCAVATION AND MONITORING
STOCK TANKS	No Action	X		
	Monitoring		X	X
	Excavation (In-drainage, Upland, or Stock Ponds)			X
	Removal of Suspended Sediments			
	Limestone Treatment			
	Sediment and Erosion Control			

TABLE 7-1
DETAILED EVALUATION OF THE REMEDIAL ALTERNATIVES - SOILS (TOTAL METALS)

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILING SOILS IU FEASIBILITY STUDY PROPOSAL

ALT	DESCRIPTION	OVERALL PROTECTION	COMPLIANCE WITH ARARs	LONG-TERM EFFECTIVENESS AND PERMANENCE	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST	GREEN REMEDIATION
1	No Action	Does not provide any form of additional overall protection of human health and the environment. However, no risk currently exists to human health and thus no action is protective. Does not meet the RAO for wildlife because does not include monitoring to ensure conditions continue to be protective.	There are no chemical-specific ARARs for surface soil except pre-FS RAC, which would not be met for wildlife because some areas occur with copper > 1100 mg/kg, and pre-FS RAC states they require monitoring. However, the portion of the pre-FS RAC that requires active remediation when copper > 1600 mg/kg is met with no action because no exposure units exceeded 1600 mg/kg.	Not effective in the long-term or permanent if changes occur in exposure	Does not reduce toxicity, mobility or volume.	Is effective in the short-term because studies show current conditions are protective.	Is implementable at the site, as no action is required.	There are no costs associated with this alternative.	No additional resources would be required to implement this alternative.
2	Monitoring	Does not provide any additional form of overall protection of human health and the environment beyond current conditions. However, the ability of the Monitoring alternative to satisfy this threshold criteria is high and achievable because it meets the requirement of the protective pre-FS RAC for small ground feeding bird that the acres with copper > 1100 mg/kg will be monitored, and the requirement that no acres should be below 1600 mg/kg copper, and none are. The monitoring ensures results for soils between 1100 mg/kg and 1600 mg/kg copper do not change and adversely affect the small ground feeding bird. Monitoring could trigger a remedial alternative over time.	There are no chemical-specific ARARs for surface soil except for the pre-FS RAC, which would be met. This alternative would meet the threshold criterion of soils between 1100 and 1600 mg/kg being monitored. It also meets the part of the pre-FS RAC that requires all soils to be ≤ 1600 mg/kg because no exposure units exceed 1600 mg/kg.	Not effective in the long-term or permanent if exposure increases. The magnitude of risk would be consistent with current conditions unless monitoring results in the implementation of additional remedial actions. However, natural attenuation may lower copper in soils due to erosion and clean windblown deposition over time, and monitoring would increase confidence in permanence of the protection. This alternative affords the opportunity to continue data collection and to take additional action if necessary.	Does not reduce toxicity, mobility, or volume.	Is effective in the short-term because studies show current conditions are protective.	This remedy is implementable at the site with limited additional effort.	Capital Costs: $148K O&M (NPV, 30 yr): $893K TIC: $1.04MM	Emissions and fuel use would be limited to those associated with light vehicles and sample shipping/analysis. This alternative would save existing vegetation from destruction.

TABLE 7-2
DETAILED EVALUATION OF THE REMEDIAL ALTERNATIVES - SOILS (pCu)

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILING SOILS IU FEASIBILITY STUDY PROPOSAL

ALTERNATIVE	DESCRIPTION	OVERALL PROTECTION	COMPLIANCE WITH ARARs	LONG-TERM EFFECTIVENESS AND PERMANENCE	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST	GREEN REMEDIATION
1	No Action	Does not provide any form of overall protection for ecological receptors beyond current conditions. Some acres were carried forward for consideration for remediation in areas where the estimated mean pCu is below the soil-specific PEL, and therefore the No Action alternative does not meet the RAOs because it does not include monitoring or treatment leading to increased protection. However, the No Action alternative may be more protective than active remedies for the vegetation community in areas with a pCu below soil-specific PELs that fall within a pCu range of uncertain benefit. The uncertain range is between the selected PELs and an alternative PEL derived by averaging rangeland condition with wildlife habitat endpoints, which is between 4.98 and 4.6 for flat rocky soil, 4.4 and 3.98 for bedrock, and 4.11 and 2.97 for slope soils. The lower end of the range may reduce the overall net ecological risk, which is the tradeoff between the benefit of reducing pCu exposure for plants and the harm from active remedies that temporarily destroy the vegetation community. The PEL used may be biased high (see Section 7.3.1 of the text for detailed explanation), which would mean the No Action alternative could be more protective than remediation in some of the acres carried forward for consideration for remediation.	There are no chemical-specific ARARs for surface soil except for the pre-FS RAC. Because no actions would be taken there are no action-specific or location-specific ARARs for this alternative. Compliance with the ARARs is low because some acres do not meet the pre-FS RAC.	The magnitude of residual risk (i.e., potential for unacceptable risk to vegetation over the long term) would be consistent with current conditions. There could be changes to pCu in surface soil due to changes in pH over time, either improving or not improving with no action. Therefore, it is uncertain if this alternative is acceptable for long term effectiveness or permanence.	Does not reduce toxicity, mobility, or volume because no treatment would be implemented.	More effective in the short term at protecting the plant community than active remedies, which temporarily destroy or damage the plant community. Less effective at protecting the community in long-term where pCu exposure is the main risk, depending on the clean-up level selected. Because no actions would be implemented, there would be no risks to the plant community or impacts to the environment during implementation.	Is implementable at the site, as no action is required.	There are no costs associated with this alternative.	No additional resources would be required to implement this alternative.
2	Monitoring	Does not provide any form of overall protection for ecological receptors beyond current conditions, and does not meet the RAOs. However, monitoring provides more data to evaluate need for remediation and may trigger a remedial alternative over time. However, as with the No Action alternative, Monitoring may be more protective for the vegetation community in areas witha pCu below soil-specific PELs that fall within a pCu range of uncertain benefit. The uncertain range is between the selected PELs and an alternative PEL derived by averaging rangeland condition with wildlife habitat endpoints, which is between 4.98 and 4.6 for flat rocky soil, 4.4 and 3.98 for bedrock, and 4.11 and 2.97 for slope soils. The lower end of the range may reduce the overall net ecological risk, which is the tradeoff between reducing pCu exposure for plants and active remedies that destroy the vegetation community during implementation. The PEL used may be biased high (see Section 7.3.1 of the text for detailed explanation), which would mean the Monitoring alternative could be more protective than remediation in some of the acres carried forward for consideration for remediation.	There are no chemical-specific ARARs for surface soil except for the pre-FS RAC. Because no actions would be taken there are no action-specific or location-specific ARARs for this alternative. The likelihood of compliance with the ARARs on an ongoing basis is low.	The magnitude of residual risk (i.e., potential for unacceptable risk to vegetation over the long term) would be consistent with current conditions unless monitoring results in the implementation of additional remedial actions. Natural attenuation may lower copper in soils due to erosion and availability to wildlife due to clean soil/dust deposition over time. It may not reduce pCu to below vegetation risk values; therefore, it is uncertain if this alternative is acceptable for long term effectiveness or permanence. However, this alternative affords the opportunity to continue data collection and to take additional action if necessary.	Does not reduce toxicity, mobility, or volume.	This alternative is more effective in the short term than active remedies because, unlike active remedies, it does not destroy the plant community being protected. No actions would be implemented so there would be no risks to the community or workers or impacts to the environment during implementation.	This remedy is implementable at the site with limited additional effort. It would not limit further actions at STSIU; however, a monitoring plan would need to be coordinated with NMED.	Capital Costs: $280K O&M (NPV, 30 yr): $1.6MM TIC: $1.9MM	Emissions and fuel use would be limited to those associated with light vehicles and sample shipping/analysis. This alternative would save existing vegetation from temporary destruction.

ALTERNATIVE	DESCRIPTION	OVERALL PROTECTION	COMPLIANCE WITH ARARs	LONG-TERM EFFECTIVENESS AND PERMANENCE	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST	GREEN REMEDIATION
3	Excavation (Reuse or Disposal) and Monitoring	This alternative would remove soils with copper and acid concentrations at levels that could pose a potential risk to vegetation from pCu. Once the ecosystem re-establishes, eventually maturing to its previous successional stage, Alternative 3 would meet the threshold criterion of overall protection of human health and the environment. As discussed in Section 7.3.1,.1, the PEL for flat rocky soils may be biased high. The beneficial effects of the Alternative on the vegetation community at pCu between 4.6 and the PEL (4.98) in flat rocky soils and in areas of bedrock (pCu between 4.4 and 3.83) and slope soil (pCu between 4.11 and 2.97) is uncertain. Since the Alternative will temporarily destroy the entire community, even the more sensitive species being protected may not return for an undetermined period of time. Remediation in areas with pCu < 4.6 in flat rocky soils is most likely to provide the highest level of overall protection for the vegetation community in the STSIU. No areas of bedrock soils with pCu < 3.83 or slope soils with pCu < 2.97, areas with more certain benefits from this Alternative, were identified.	There are no chemical-specific ARARs for surface soil except for the pre-FS RAC. Action-specific and location-specific ARARs would be met by remedial design. Alternative 3 is expected to meet the threshold criterion of compliance with ARARs if careful attention is given to restoring the soil productivity and plant community after soil removal.	This alternative would provide a high level of long-term effectiveness and permanence for soil categories that can be excavated (i.e., flat rocky soils) after species return after an undetermined but potentially long time frame. Removal is a proven and reliable method of preventing the potential for contact with materials of concern. Monitoring of erosion from removal areas and soil sampling would be required to ensure that recontamination did not occur. Excavation will temporarily destroy the entire vegetation community. Because the beneficial effects of excavation on the vegetation community at pCu between 4.6 and the PEL (4.98) in flat rocky soils is uncertain, the long-term effectiveness of excavation in those areas may be lower than in the areas with pCu < 4.6 in flat rocky soils.	This alternative would not meet the statutory preference for treatment. Alternative 3 does not reduce the toxicity, mobility, or volume because no treatment would be implemented; only contaminated soil will be removed.	Alternative 3 would be ineffective at achieving the goal of protecting the vegetation community, wildlife habitat, and rangeland in the short term. Excavation would destroy the entire community, including both less sensitive and more sensitive species, and many species may not return for an extended period of time. When active remedy occurs at < PELs, the whole community is affected by the remedy. While there is some gain to improve soil conditions for more sensitive species, the short term effectiveness may be limited because all species are simultaneously destroyed during implementation. Also, Alternative 3 would entail significant earthwork which would result in a risk to workers due to physical hazards, particularly working on steep and potentially unstable slopes. Placing heavy equipment on slopes to regrade them could increase the risk of slope failure. Site preparation, soil excavation, transport and disposal onsite are significant construction activities that will require transport of heavy equipment to the site. In addition, the use of heavy equipment for grading and earthwork would release diesel emissions into the environment.	This alternative is considered moderately implementable. Excavation would not be implementable in areas of bedrock outcrops or steep slopes. Of the 377 acres brought forward for consideration of remediation, 47 are on bedrock and 14 are on steep slopes. The presence of these two physical factors limits the implementability of this alternative in these areas. Soil excavation, transportation and onsite disposal can be achieved in flat rocky soils with standard equipment and materials. Site preparation will include building new roads for haulage. Excavated soil, greater than the PELs, would either be taken to the operational area for subsequent reuse or taken to the West Stockpile for recycling (disposal option).	Capital Costs: $8.9MM O&M (NPV, 30 yr): $2.2MM TIC: $11.1MM	Additional emissions and fuel use would be required to excavate the material. The material would be reused or recycled. This alternative would result in the temporary destruction of existing vegetation.While the duration of the disturbance to vegetation is unknown, it could last for an extended period of time.
4	Soil Amendments (Lime), Tilling and Monitoring	The ability of this alternative to satisfy this criterion is high on relatively level habitats, particularly if on poor rangeland. Tilling has been shown to be effective on the site (e.g. for ripped roads, see Appendix A). Copper present in surface soils would be tilled and mixed deeper into the soil along with bringing higher pH soils to the surface. Tilling also provides the benefit of breaking up the soil to allow plant growth. Additionally, tilling would likely increase the rate of natural attenuation, though natural attenuation rates for pCu have not been determined. The addition of lime would also increase pCu in soils and reduce the bioavailability of any remaining copper, although the application of lime alone (where tilling is impractical) would have a low to moderate ability to satisfy this criterion. As discussed in Section 7.3.1.1,, the PEL for flat rocky soils may be biased high. The beneficial effects of the Alternative on the vegetation community at pCu between 4.6 and the PEL (4.98) in flat rocky soils and in areas of bedrock (pCu between 4.4 and 3.83) and slope soil (pCu between 4.11 and 2.97) is uncertain. Since the Alternative will temporarily destroy the entire community, even the more sensitive species being protected may not return for an undetermined period of time. Remediation in areas with pCu < 4.6 in flat rocky soils is most likely to provide the highest level of overall protection for the vegetation community in the STSIU. No areas of bedrock soils with pCu < 3.83 or Slope soils with pCu < 2.97 , aras with more certain benefits from this Alterantive, were identified.	There are no chemical-specific ARARs for surface soil except for the pre-FS RAC. Action-specific and location-specific ARARs would be met by remedial design. Alternative 4 would likely meet the threshold criterion of compliance with ARARs if tilling is included. It is less certain on steeper slopes where lime has runoff and has been less effective.	The long-term effectiveness of this alternative is considered moderate for amendments for improving pCu but high for tilling for improving the plant community if in flat rocky soils. Lime (calcium carbonate) has been shown to increase pCu values at the site but does not always increase pCu values at the site to pre-FS RAC levels. Tilling of flat rocky soils < PELs would temporarily destroy the entire community, including both less sensitive and more sensitive species, and many species would not return for an undetermined but potentially long time frame. Alternative 4 would provide a high level of long-term effectiveness and permanence only after species return. Its effectiveness in bedrock and on steep slopes is low, given tilling can not be done in bedrock and tilling equipment is difficult to use on steep slopes. Liming may be more effective in bedrock and steep slopes but the effectiveness is uncertain because lime is easily washed off with rainfall in these areas. Additional applications of soil amendments may be required in bedrock outcrops or on steep slopes due to transportation of material from storm water flows.	This alternative would mix the upper soil layers with underlying soils, increasing pCu. In combination with adding lime, tilling would reduce toxicity and amount of acid in the soils by reducing the bioavailability and mobility and thus toxicity of the copper.	This alternative would not be considered moderately effective in the short-term. Mixing of surface soils with deeper soil layers resulting from tilling is expected to increase pH, decrease soil copper, and improve conditions for plant growth. However, it may take several years for the soil amendments to increase the pCu values. Also, tilling would temporarily destroy the entire community, including both less sensitive and more sensitive species, and many species would not return for an undetermined but potentially long time frame. When active remedy occurs on areas with pCu < PEL levels for the specific soil type, the whole community is affected by the remedy. While there is some gain to improve soil conditions for more sensitive species, there is limited short term effectiveness because all species are simultaneously affected during implementation.. If lime is only applied (no tilling), as it was on steeper slopes in the amendment study (only up to 13% slope), it may still adversely impact the plant community in the short term (observed during amendment study), and only slightly increase the pCu.	The implementability of soil amendments is considered high compared to the other alternatives. If tilling is excluded, iit s an alternative that could be applied to areas with steep slopes and bedrock outcrop areas, which cannot be addressed by physical means. However, additional applications of soil amendments may be required in the future in bedrock outcrops or steep slopes due to the transportation of amendments in storm water. Tilling is considered moderately implementable as it could not be used in areas of bedrock outcrops or steep slopes but is effective in flat, rocky soils.	Capital Costs: $4.2MM O&M (NPV, 30 yr): $2.2MM TIC: $6.4MM	Emissions and fuel use would be lower than Alternative 3 but higher than Alternative 5. This alternative would result in the temporary destruction of existing vegetation. While the duration of the disturbance to vegetation is unknown it could last for an extended period of time.

TABLE 7-2
DETAILED EVALUATION OF THE REMEDIAL ALTERNATIVES - SOILS (pCu)

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILING SOILS IU FEASIBILITY STUDY PROPOSAL

ALTERNATIVE	DESCRIPTION	OVERALL PROTECTION	COMPLIANCE WITH ARARs	LONG-TERM EFFECTIVENESS AND PERMANENCE	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST	GREEN REMEDIATION
5	Tilling and Monitoring	The ability of this alternative to satisfy this criterion is high for slopes that are not too steep. Tilling has been shown to be effective on the site (e.g. for ripped roads, see Appendix A). Copper present in surface soils would be tilled and mixed deeper into the soil along with bringing higher pH soils to the surface. Tilling also provides the benefit of breaking up the soil to allow plant growth. Additionally, tilling would increase the rate of natural attenuation, though natural attenuation rates for pCu have not been determined. However, the net environmental benefit may be lower than alternatives without destructive remediation in areas with pCu below soil-specific PELs, as tilling temporarily destroys the entire community, including both less sensitive species that are thriving and more sensitive species that would benefit, and many species, includingthe more sensitive species being protected, would not return for an potentially extended period of time.	There are no chemical-specific ARARs for surface soil except for the pre-FS RAC. Action-specific and location-specific ARARs would be met by remedial design. Alternative 5 may meet the threshold criterion of compliance with ARARs. The likelihood of achieving the desired pCu ($\geq$ the PELs) is moderate with tilling but the likelihood of achieving a more diverse community with greater plant cover is high.	The long-term effectiveness of this alternative is considered moderate for tilling for pCu but high for tilling for improving the plant community if in flat rocky soils. Tilling would destroy the entire community, including both less sensitive and more sensitive species until the species return, which may be for an extended period of time, Because the beneficial effects of tilling in flat rocky soils (the soil type in which tilling is most effective) at pCu between 4.6 and the PEL (4.98) is uncertain, the long-term effectiveness of tilling in those areas with pCu between 4.6 and 4.98 may be lower than in the areas with pCu < 4.6 in flat rocky soils. Alternative 5 would provide a high level of long-term effectiveness and permanence only after species return. Its effectiveness in bedrock and on steep slopes is low, given tilling can not be done in bedrock and tilling equipment is difficult to use on steep slopes. Monitoring of erosion from removal areas and soil sampling would be required to ensure that recontamination did not occur.	This alternative would mix the upper soil layers with underlying soils, decreasing concentrations of copper, increasing pH, and thus toxicity in the soils and amount of acid would be reduced. Mobility also may be reduced.	This alternative would not be considered moderately effective in the short-term. Mixing of surface soils with deeper soil layers resulting from tilling is expected to increase pH, decrease soil copper, and improve conditions for plant growth. However, it may take several years for the tilling to increase the pCu values. That said, as described above, tilling at pCu at PELs specific to soil type would temporarily destroy the entire community, including both less sensitive and more sensitive species, and many species, including the more sensitive species, may not return for an extended period of time. When active remedy occurs, the whole community is affected by the remedy. While there is some gain to improve soil conditions for more sensitive species, there is no short term effectiveness because all species are simultaneously affected.	The implementability of this alternative is considered moderate. It has the same limitations as Alternative 3; soil tilling can be achieved with standard equipment and materials and with no extensive site preparation but could not be used in areas of bedrock outcrops or steep slopes.	Capital Costs: $3.7MM O&M (NPV, 30 yr): $2.2MM TIC: $5.9MM	Emissions and fuel use would be lower than Alternative 3. A medium-sized dozer with a ripper could implement this alternative with relatively lower fuel use and less support requirements. This alternative would result in destruction of existing vegetation.
6	Soil Amendments (Ferrihydrite), Tilling and Monitoring	The ability of this alternative to satisfy this criterion is possibly high similar to lime and tilling described in Alternative 4 but the effectiveness of ferrihydrite has not been tested on the site. Tilling has been shown to be effective on the site (e.g. for ripped roads, see Appendix A). Copper present in surface soils would be tilled and mixed deeper into the soil along with bringing higher pH soils to the surface. Tilling also provides the benefit of breaking up the soil to allow plant growth. Additionally, tilling would increase the rate of natural attenuation, though natural attenuation rates for pCu have not been determined. The addition of ferrihydrite would be expected to decrease free cupric ion activity in soils and reduce the bioavailability of any remaining copper. The beneficial effects of the Alternative on the vegetation community at pCu between 4.6 and the PEL (4.98) in flat rocky soils and in areas of bedrock (pCu between 4.4 and 3.83) and slope soil (pCu between 4.11 and 2.97) is uncertain. The net environmental benefit may be lower than alternatives without destructive remediation in areas with pCu falling in the uncertain benefit range. Tilling temporarily destroys the entire community, including both less sensitive species that are thriving and more sensitive species that would benefit, and many species, even the more sensitive species being protected, may not return for an extended period of time.	There are no chemical-specific ARARs for surface soil except for the pre-FS RAC, which might be met. Action-specific and location-specific ARARs would be met by remedial design. The likelihood that Alternative 6 would meet the threshold criterion of compliance with ARARs is considered moderate for ferrihydrite alone and high if combined with tilling.	The long-term effectiveness of this alternative is considered moderate to high to increase pCu values. Ferrihydrite has been shown to reduce free cupric ion activity at similar sites. Additionally, pCu values may increase over time with an increased rate of natural attenuation resulting from tilling. However, although less mobile than lime, additional applications of ferrihydrite amendments may be required in bedrock outcrops or on steep slopes due to transportation of material from storm water flows. Tilling, implementable in flat rocky soils, would temporarily destroy the entire community, including both less sensitive and more sensitive species, and many species may not return for an extended period of time. Alternative 6 would provide a high level of long-term effectiveness and permanence only after species return. The effectiveness of tilling in bedrock and on steep slopes is low, given tilling can not be done in bedrock and tilling equipment is difficult to use on steep slopes. Monitoring of erosion from removal areas and soil sampling would be required to ensure that recontamination did not occur.	Tilling in this alternative would mix the upper soil layers with underlying soils, increasing pCu and thus reducing toxicity and amount of acid in the soils. Mobility and toxicity would be reduced by the addition of ferrihydrite.	This alternative would not be considered effective in the short-term. Mixing of surface soils with deeper soil layers resulting from tilling with soil amendments is expected to increase pH, decrease soil copper, and improve conditions for plant growth. However, it may take several years for the soil amendments to increase the pCu values and the increase may be small if copper concentrations are high. Tilling of soils with pCu at < PELs of the specific soil type would destroy the entire community, including both less sensitive and more sensitive species, and many species may not return for an extended period of time. While there is some gain to improve soil conditions for more sensitive species, there is no short term effectiveness because all species are simultaneously affected.	The implementability of soil amendments is considered high. It is an alternative that could be applied to areas with steep slopes and bedrock outcrop areas, which cannot be addressed by physical means. Additional applications of soil amendments may be required in the future in bedrock outcrops or steep slopes due to the transportation of amendments in storm water. Tilling is considered moderately implementable as it could not be used in areas of bedrock outcrops or steep slopes.	Capital Costs: $4.2MM O&M (NPV, 30 yr): $2.2MM TIC: $6.4MM	Emissions and fuel use would be lower than Alternative 3 but higher than Alternative 5. This alternative would result in temporary destruction of existing vegetation. While the duration of the disturbance to vegetation is unknown it could last for an extended period of time.

TABLE 7-2
DETAILED EVALUATION OF THE REMEDIAL ALTERNATIVES - SOILS (pCu)

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILING SOILS IU FEASIBILITY STUDY PROPOSAL

ALTERNATIVE	DESCRIPTION	OVERALL PROTECTION	COMPLIANCE WITH ARARs	LONG-TERM EFFECTIVENESS AND PERMANENCE	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST	GREEN REMEDIATION
7	Soil Cover and Monitoring	Soil cover would reduce but not eliminate plant contact with the contaminants. Also, the pathways would only be closed if the soil cover remains in place. The soil cover could be breached by digging, construction, or similar activities, or by plants with deep roots. This could potentially pose a risk to the vegetation. Additionally, in soils with pCu between the selected PELs and the lower PELs identified when thresholds for rangeland wildlife habitat are averaged (the "uncertain" pCu effect range), the net environmental benefit may be lower than alternatives without destructive remediation, as soil cover destroys the entire community, including both less sensitive species that are thriving and more sensitive species that would benefit. Many species, even the more sensitive species being protected, may not return for an extended period of time.	There are no chemical-specific ARARs for surface soil except for the pre-FS RAC. Action-specific and location-specific ARARs would be met by remedial design. Alternative 7 would meet the threshold criterion of compliance with ARARs.	A soil cover would require long-term operations, maintenance, and monitoring to continue to be effective. A soil cover would be considered a moderately effective solution. Soil cover in areas with pCu of < PELs would temporarily destroy the entire community, including both less sensitive and more sensitive species, and many species might not return for an extended period of time. Alternative 7 would provide a high level of long-term effectiveness and permanence only after species return.	This alternative would not meet the statutory preference for treatment. Alternative 7 does not reduce the toxicity, mobility, or volume because no treatment would be implemented; only contaminated soil would be covered.	This alternative is not considered to be effective in the short-term. It would address all of the pCu areas < PELs; however, soil cover over acres below the PELs would destroy the entire community, including both less sensitive and more sensitive species, and many species may not return for an extended period of time, even after seeding. When active remedy occurs in areas of < PEL of the specific soil type, the whole community is affected by the remedy. While there is some gain to improve soil conditions for more sensitive species, there is no short term effectiveness because all species are simultaneously affected. Vegetation in borrow areas would be adversely impacted in the short-term, too.	This alternative is considered moderately implementable. Unlike excavation, placing a soil cover could be implementable in areas of bedrock outcrops but would be difficult in steep slopes, and might erode off bedrock, also. Covering bedrock on 47 acres would require large amounts of soil and large borrow areas. Of the 377 acres addressed for pCu exposure, 14 acres are on steep slopes. More maintenance is required with this option than for other alternatives.	Capital Costs: $11.0MM O&M (NPV,30yr): $2.2MM TIC: $13.2MM	This alternative would result in similar emissions and fuel use when compared to Alternative 3. This alternative would result in temporary destruction of existing vegetation.While the duration of the disturbance to vegetation is unknown it could last for an extended period of time.
8	Surface Soil Controls - Phytostabilization	The overall protection of this alternative would be low. Contaminant reduction through limiting transport would take several years to achieve, and it would not reduce toxicity to the site vegetation it is designed to protect. Additionally, the net environmental benefit may be lower than alternatives without destructive remediation in areas in the uncertain pCu range, as the phytostabilization process destroys and replaces existing plants, including both less sensitive species that are thriving and more sensitive species that would benefit. Many desired species, even the more sensitive species being protected, would not return for decades.	There are no chemical-specific ARARs for surface soil except for the pre-FS RAC. Action-specific and location-specific ARARs would be met by remedial design. Alternative 8 would not meet the threshold criterion of compliance with ARARs because it is unlikely to meet the pre-FS RAC.	The long-term effectiveness for this alternative is considered to be very low compared to the other alternatives. Phytostabilization has the potential to be effective at stabilizing the soils and reducing transport of impacted soils. However, this technology used alone would not be effective at reducing site contaminant levels and/or exposure to the plants the remediation is supposed to protect.	This alternative would not meet the statutory preference for treatment. Alternative 8 does not reduce the toxicity, mobility, or volume because no treatment would be implemented. This technology used alone would not be effective at reducing site contaminant levels and/or exposure to site receptors.	This alternative would be considered not to be effective in the short-term because of the length of time required for the native vegetation, destroyed during the remediation, to become established relative to an uncertain benefit in that the pCu onsite may not improve. Additionally, as described above, phytostabilization would destroy many species in the community and many species may not return for an extended period of time. When this active remedy occurs at < PELs, species insensitive and sensitive to pCu are affected by the planting of other species used for phytostabilization. While there is some gain to improve soil stability, there is no short-term effectiveness because the community is disrupted by the planting and remedial activities.	Revegetating soils with species that are targeted for soil stabilization is generally considered implementable at the Site. There may be certain areas of the site that may not support the phytostabilization species (due to slopes, percent soil coverage, and soil conditions). Plant species and potential locations would be determined during the remedial design process.	Capital Costs: $4.1MM O&M (NPV, 30 yr): $2.5MM TIC: $6.6MM	This alternative would result in lower emissions and fuel than all but Alternatives 1 and 2.

TABLE 7-4
DETAILED EVALUATION OF THE REMEDIAL ALTERNATIVES - SURFACE WATER DRAINAGES

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILING SOILS IU FEASIBILITY STUDY PROPOSAL

ALTERNATIVE	DESCRIPTION	OVERALL PROTECTION	COMPLIANCE WITH ARARs	LONG-TERM EFFECTIVENESS AND PERMANENCE	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST	GREEN REMEDIATION
1	No Action	Does not provide any additional form of overall protection of human health and the environment beyond current conditions. However, current exposure for all but the D3 drainage on average likely is low and protective overall, because only a small percentage of the samples in the drainages had an HQ > 1. Additionally, impacts to the environment are likely small because pool habitat is limited in these areas. However, this alternative does not address the uncertainty of the current conditions, and therefore does not meet the RAOs.	Alternative 1 is not compliant with ARARs because it is no action and there are some exceedances of copper based on NMAC §20.6.4.808 – 809 that need to be addressed with monitoring or other actions. Copper is the focus because it is main driver of risk, having significantly higher HQs than cadmium and lead, the other COCs for the drainages.	Not effective in the long-term or permanent because it does not address the exceedances for copper. However, natural attenuation may be happening, but without monitoring to ascertain the rates, this alternative is not protective. This alternative has the benefit of preserving the existing upland vegetation and aquatic ecosystem, both of which would take decades to recover following the implementation of an active remedial alternative.	Alternative 1 does not reduce toxicity, mobility or volume because it does not involve any active remedy.	Not effective in the short-term because no action to address exceedances.	Is implementable at the site, as no action is required.	There is no costs associated with this alternative.	No additional resources would be required to implement this alternative.
2	Monitoring	Does not provide any form of overall protection of human health and the environment. Does not meet the RAOs. However, current exposure for all but the D3 drainage on average is low and protective overall, because only a small percentage of the samples in the drainages had an HQ > 1. Additionally, impacts to the environment are likely small because pool habitat is limited in these areas. Monitoring may be protective because it provides more data to evaluate need for remediation and may trigger a remedial alternative over time.	The Monitoring alternative is not immediately compliant with ARARs or the pre-FS RAC for some point locations, but may be meeting it for drainages on average. Monitoring would allow for adaptability and may trigger remedial activities over time. In this case, the likelihood of compliance with ARARs is dependent on whether pre-FS RAC are met when evaluated across the drainages currently and dependent on the management of upstream sources, suspended sediment and dissolved metals concentrations, as well as overall water quality and attenuation rates.	The effectiveness of this remedial alternative in the long-term is limited to reduce concentrations to below aquatic life standards because it depends on natural attenuation, which appears to be occurring or may have already occurred for all but Drainage D3. However, it may be effective enough to address long-term risks if upstream sources of contaminants are addressed. Additionally, this alternative affords the opportunity to continue data collection and to take additional action if necessary.	Alternative 2 does not reduce toxicity, mobility or volume because it does not involve any active remedy.	Not effective in the short-term because no action to address exceedances. However, current conditions may be protective for all but Drainage D3. Monitoring in the short term of all the retained drainages may trigger an action if conditions warrant it.	This remedy is implementable at the site with limited additional effort. Long-term monitoring would be required to show improvements in water quality in the surface water drainages.	Capital Costs: $20K O&M (NPV, 30 yr): $293K TIC: $313K	Emissions and fuel use would be limited to those associated with light vehicles and sample shipping/analysis. This alternative would save existing vegetation from destruction.
3	Excavation and Monitoring	The ability of this alternative to meet the overall protection of water quality is high to moderate. The overall protection is based on the removal of historical sediments, but also a reduction of potential upstream contributors. This alternative would destroy the existing upland and riparian vegetation and aquatic ecosystem initially, and the vegetation could take decades to recover following the implementation of an active remedial alternative. The pools are limited and dry in drier years, particularly in alluvial drainages, providing limited habitat. The trade-off of remediation benefits and loss of riparian vegetation supports this remedy only for Drainage D3 that has high HQs.	The likelihood of compliance with the ARARs on an ongoing basis is moderate to high with this alternative. This is the potential for reduced long-term effectiveness of this alternative if upstream contributions continue. Additional excavation may be required at a future time.	The effectiveness of this remedial alternative in the long-term is high to moderate to reduce concentrations to aquatic life standards. In recent efforts to re-sample, areas of concern were dry so long-term effectiveness at protecting aquatic biota could be low if frequently dry. Once excavation of historical sediments is complete, monitoring will be required to document that water quality criteria have been met. Long-term effectiveness of this alternative may be dependent on addressing upstream contributors (suspended sediments and storm water).	This alternative would not meet the statutory preference for treatment. Alternative 3 does not reduce the toxicity, mobility, or volume because no treatment would be implemented.	This alternative is considered moderately effective in the short-term. Surface water quality may take some time to improve. Normal risks associated with nuisance dust, excavation hazards, noise and traffic.	In specific surface water drainages this alternative will potentially be difficult to implement compared to other alternatives. Specifically in the Bolton Spring and Ash Spring corridor the excavation of historical sediments may do more harm than good to the ecological habitat. Additional permitting and coordination would be required compared to other alternatives. For other drainages the excavation of historical sediments is considered implementable. Some of the drainages may not be accessible to large equipment, due to steep slopes or tight access. However, overall this alternative is implementable at the site. No special equipment is required to complete this alternative. Equipment and materials to complete the job are readily available.	Capital Costs: $569K O&M (NPV, 30 yr): $388K TIC: $958K	Additional emissions and fuel use would be required to excavate the drainages. The constrained environment would also reduce efficiency. This alternative would result in destruction of existing vegetation.

TABLE 7-4
DETAILED EVALUATION OF THE REMEDIAL ALTERNATIVES - SURFACE WATER DRAINAGES

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILING SOILS IU FEASIBILITY STUDY PROPOSAL

ALTERNATIVE	DESCRIPTION	OVERALL PROTECTION	COMPLIANCE WITH ARARs	LONG-TERM EFFECTIVENESS AND PERMANENCE	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST	GREEN REMEDIATION
4	Instream Removal of Suspended Sediments and Monitoring	The ability of this alternative to meet the overall protection of water quality is moderate to high. The overall protection is based on the installation of limestone sedimentation basins within the drainage channels, thereby decreasing the bioavailability of copper in surface water. Long-term monitoring is suggested for the implementation of this alternative.	The likelihood of compliance with the ARARs on an ongoing basis is high, and potentially higher than Alternative 3. There is the potential for reduced long-term effectiveness of this alternative if upstream contributions continue. Additional excavation should be anticipated within the sedimentation basins in the future. The addition of limestone to treat bioavailability of copper increases the potential compliance with ARARs.	The effectiveness of this remedial alternative in the long-term is high to moderate to reduce concentrations to aquatic life standards. Once excavation of historical sediments with the installation is complete and sedimentation basins are installed to collect suspended sediment monitoring will be required to document that water quality criteria have been met. Overall long-term effectiveness will also depend on any additional potential upstream sources of contaminants. Chemical treatment of the surface would increase the potential effectiveness of this alternative compared to Alternative 3.	This alternative addresses toxicity by reducing the bioavailability of copper due to the presence of limestone in the sedimentation basins. It also reduces the mobility of the contaminants by removing them from contact with surface water. The volume of material will be reduced with this alternative and it will also prevent potential contamination of surface water due to the presence of historical sediments.	This alternative is considered moderately effective in the short-term. Surface water quality may take some time to improve, and building a road into these areas to install the sediment basins will destroy vegetation in the short-term. Normal risks will occur associated with nuisance dust, excavation hazards, noise, and traffic.	In specific surface water drainages this alternative will be potentially difficult to implement compared to other alternatives. Specifically, in the Bolton Spring and Ash Spring corridor, the excavation of historical sediments may do more harm than good to the ecological habitat. Additional permitting and coordination would be required compared to other alternatives due to the excavation component. Specifically for the critical habitat transect, excavation may be omitted and only limestone sedimentation basins placed in the surface water drainages. For other drainages, the excavation of historical sediments is considered implementable. Some of the drainages may not be accessible to large equipment, due to steep slopes or tight access. These factors make the implementability of this alternative more challenging than other alternatives. No special equipment is required to complete this alternative. Equipment and materials to complete the job are readily available.	Capital Costs: $2.4MM O&M (NPV, 30 yr): $388K TIC: $2.8MM	Emissions and fuel use would be higher than Alternative 3, as additional sediment control measures and treatment are added, both of which increase emissions and natural resource use through manufacturing, material hauling, and maintenance. This alternative would result in destruction of existing vegetation.
5	Limestone Treatment and Monitoring	The ability of this alternative to meet the overall protection of water quality is moderate to high. The overall protection is based on the installation of limestone in low-lying, low-energy areas within the drainage channels, thereby decreasing the bioavailability of copper in surface water. Long-term monitoring is suggested for the implementation of this alternative.	The likelihood of compliance with the ARARs on an ongoing basis is moderate to high, as lime would be placed in the stream channels without excavation in areas where velocities are low. The limestone would decrease the bioavailability of copper and increases the potential compliance with ARARs.	The effectiveness of this remedial alternative in the long-term is moderate to reduce concentrations to aquatic life standards, as this technology allows water to pass through the limestone without the benefit of basins to increase the resident time of the water. Similar to Alternative 4, overall long-term effectiveness will also depend on any additional potential upstream sources of contaminants.	This alternative addresses toxicity by reducing the bioavailability of copper due to the presence of limestone in the drainage channels.	This alternative is considered moderately effective in the short-term. Surface water quality may take some time to improve. Normal risks associated with nuisance dust, excavation hazards, noise, and traffic.	In specific surface water drainages this alternative will be potentially difficult to implement compared to other alternatives. Specifically, in the Bolton Spring and Ash Spring corridor, the placement of lime may do more harm than good to the ecological habitat. Some of the drainages may not be accessible to large equipment, due to steep slopes or tight access. These factors make the implementability of this alternative more challenging than other alternatives. No special equipment is required to complete this alternative. Equipment and materials to complete the job are readily available.	Capital Costs: $8.7MM O&M (NPV, 30 yr): $931K TIC: $9.6MM	Emissions and fuel use would be about the same as Alternative 4, as excavation would not be required but more frequent replenishment of lime may be required. This alternative would result in destruction of existing vegetation.
6	Sediment Control, Erosion Control, and Monitoring	The ability of this alternative to meet the overall protection of water quality is low to moderate. The overall protection of this alternative is based on the control of suspended sediments and potentially dissolved concentrations in storm water. This alternative does not address historical sediments. The addition of limestone as part of the BMPs to treat dissolved/bioavailable copper would increase the potential compliance with ARARs.	The ability of this alternative to comply with this criterion is low to moderate.	The long-term effectiveness of this alternative is low to moderate. A significant amount of maintenance and monitoring will be required to implement a large enough sediment and erosion control program across all of the drainages. Potential excavation and maintenance of the BMPs would be required on a regular basis to keep this alternative effective.	This alternative (without limestone treatment) would not meet the statutory preference for treatment. Alternative 6 does not reduce the toxicity, mobility, or volume because no treatment would be implemented. If limestone or other material is used, toxicity and volume of the constituents may be reduced. Mobility of the constituents may be reduced.	This alternative would be low to moderately effective in the short-term. This alternative does not address the presence of historical sediments in the drainages. This alternative would take time for water quality to improve.	In specific surface water drainages, this alternative will be potentially difficult to implement compared to other alternatives. Some of the drainages may not be accessible to large equipment, due to steep slopes or tight access. Equipment and materials to complete the job are readily available.	Capital Costs: $3.6MM O&M (NPV, 30 yr): $560K TIC: $4.2MM	This alternative would result in the highest emissions and fuel use of the five alternatives. Although excavation is removed as an activity, erosion control is added which comes with considerably more material use and maintenance. This alternative would result in destruction of existing vegetation.

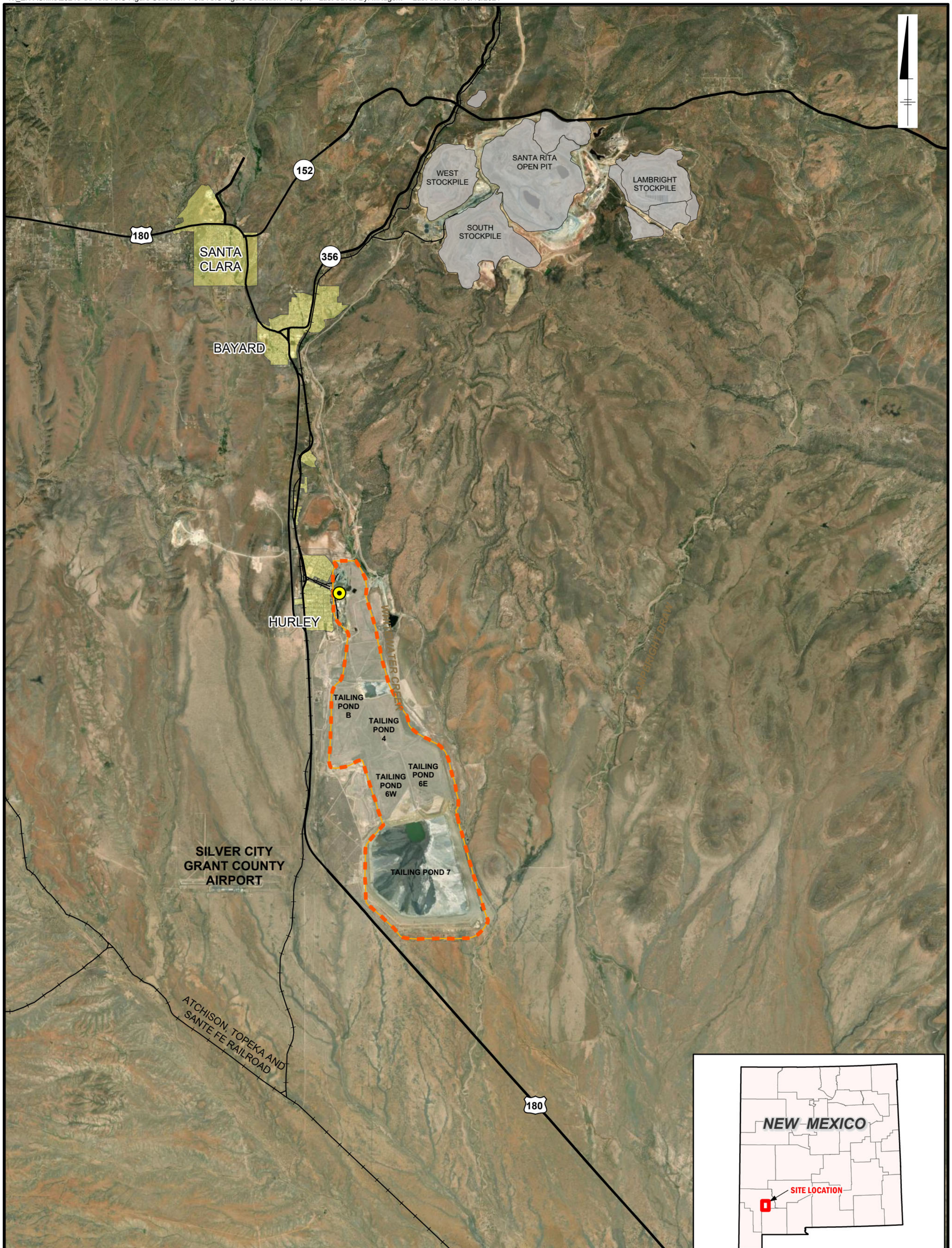
TABLE 7-5
DETAILED EVALUATION OF THE REMEDIAL ALTERNATIVES - SURFACE WATER STOCK TANKS

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILING SOILS IU FEASIBILITY STUDY PROPOSAL

ALTERNATIVE	DESCRIPTION	OVERALL PROTECTION	COMPLIANCE WITH ARARs	LONG-TERM EFFECTIVENESS AND PERMANENCE	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST	GREEN REMEDIATION
1	No Action	Does not provide any form of overall protection of human health and the environment. Does not meet the RAOs. However, current exposure likely is low and protective overall, because HQs have oscillated between 1 and 2 since 2007 and improvements were made in 2023 to provide for stable stormwater conveyance to the tank inlet. Because of these improvements, it is expected that water quality will continue to improve in stock tank 06 with time and may eventually meet the pre-FS RAC and RAOs.	Alternative 1 is not compliant with ARARs because it is no action and there are some exceedances of copper that need to be addressed with monitoring or other actions.	Alternative 1 is not effective in the long-term or permanent because it is no action and there are some exceedances for copper. However, natural attenuation may be happening, particularly following the 2023 rangeland improvements, but without monitoring to ascertain the rates, this alternative is not protective.	Alternative 1 does not reduce toxicity, mobility or volume because it is the no action alternative and does not provide treatment.	Alternative 1 is not effective in the short-term because it is no action and there are some exceedances for copper.	Is implementable at the site, as no action is required.	There is no costs associated with this alternative.	No additional resources would be required to implement this alternative.
2	Monitoring	Does not provide any form of overall protection of human health and the environment. Does not meet the RAOs. However, current exposure likely is low and protective overall, because HQs have oscillated between 1 and 2 since 2007 and improvements were made in 2023 to provide for stable stormwater conveyance to the tank inlet. Because of these improvements, it is expected that water quality will continue to improve in stock tank 06 with time and may eventually meet the pre-FS RAC and RAOs. Monitoring may trigger remedial activities over time.	This alternative is not immediately compliant with ARARs and there are some exceedances of copper. However, monitoring allows for adaptability and may trigger remedial activities over time. In this case, the likelihood of compliance with ARARs is dependent on the management of upstream sources, suspended sediment and dissolve metals concentrations, as well as overall water quality.	This alternative may be effective in the long-term for reducing concentrations to below aquatic life standards with natural attenuation after the rangeland improvements. This alternative may be effective enough to address long-term risks because upstream sources of contaminants are concurrently addressed with the 2023 rangeland improvements. Additionally, monitoring affords the opportunity to continue data collection and to take additional action if necessary.	This alternative does not reduce toxicity, mobility or volume because it is the no action alternative and does not provide treatment.	This alternative may be effective in the short term, despite some exceedances for copper. The rangeland improvements conducted in 2023 may have already improved water quality in the short term, but the monitoring program is needed to establish if this occurred.	This remedy is implementable at the site with limited additional effort.	Capital Costs: $14K O&M (NPV, 30 yr): $243K TIC: $258K	Emissions and fuel use would be limited to those associated with light vehicles and sample shipping/analysis.
3	Excavation and Monitoring	Removal of historical sediments from stock tanks would address a major contributor to aquatic risk; however, there is still the potential for long-term risk to aquatic receptors due to upstream contribution from either suspended sediments or dissolve metals concentrations in surface water. Improvements were made in 2023 to provide for stable stormwater conveyance to the tank inlet. Because of these improvements, it is expected that water quality will continue to improve with time with or without active remediation.	The likelihood of compliance with the ARARs on an ongoing basis is moderate to high with this alternative. There is the potential for reduced long-term effectiveness of this alternative if upstream contributions continue. Additional excavation may be required at a future time.	The effectiveness of this remedial alternative in the long-term is high to moderate to reduce concentrations to below aquatic life standards. Once excavation of historical sediments is complete, monitoring will be required to document that water quality criteria have been met.	This alternative would not meet the statutory preference for treatment. Alternative 6 does not reduce the toxicity, mobility, or volume because no treatment would be implemented.	This alternative is considered effective in the short-term. Normal risks associated with nuisance dust, excavation hazards, noise, and traffic. Coordination may need to be made to provide alternative water sources to tanks owners during construction.	Based on the location and accessibility of stock tank 6, this alternative is implementable at the site. Equipment and materials to complete the job are readily available.	Capital Costs: $80K O&M (NPV, 30 yr): $245K TIC: $325K	Additional emissions and fuel use would be required to excavate the material from the stock tanks and haul it to the operation area. The material would be reused and recycled.

Figures

AUTHOR: MB
PROJECT# B0063543.0000
T:_ENV\Chino\2024\FS\Pro\STSIU Figure Collection 1-3\STSIU Figure Collection 1-3.aprx   Last Saved By: MNugent   Last Saved On: 9/10/2024



LEGEND:

- Location of former Hurley Smelter
- Railroad
- Major Roads
- Stockpiles
- Local City
- Operational Boundary of Smelter and Tailing Ponds

Service Layer Credits: ESRI World Imagery:
Earthstar Geographics

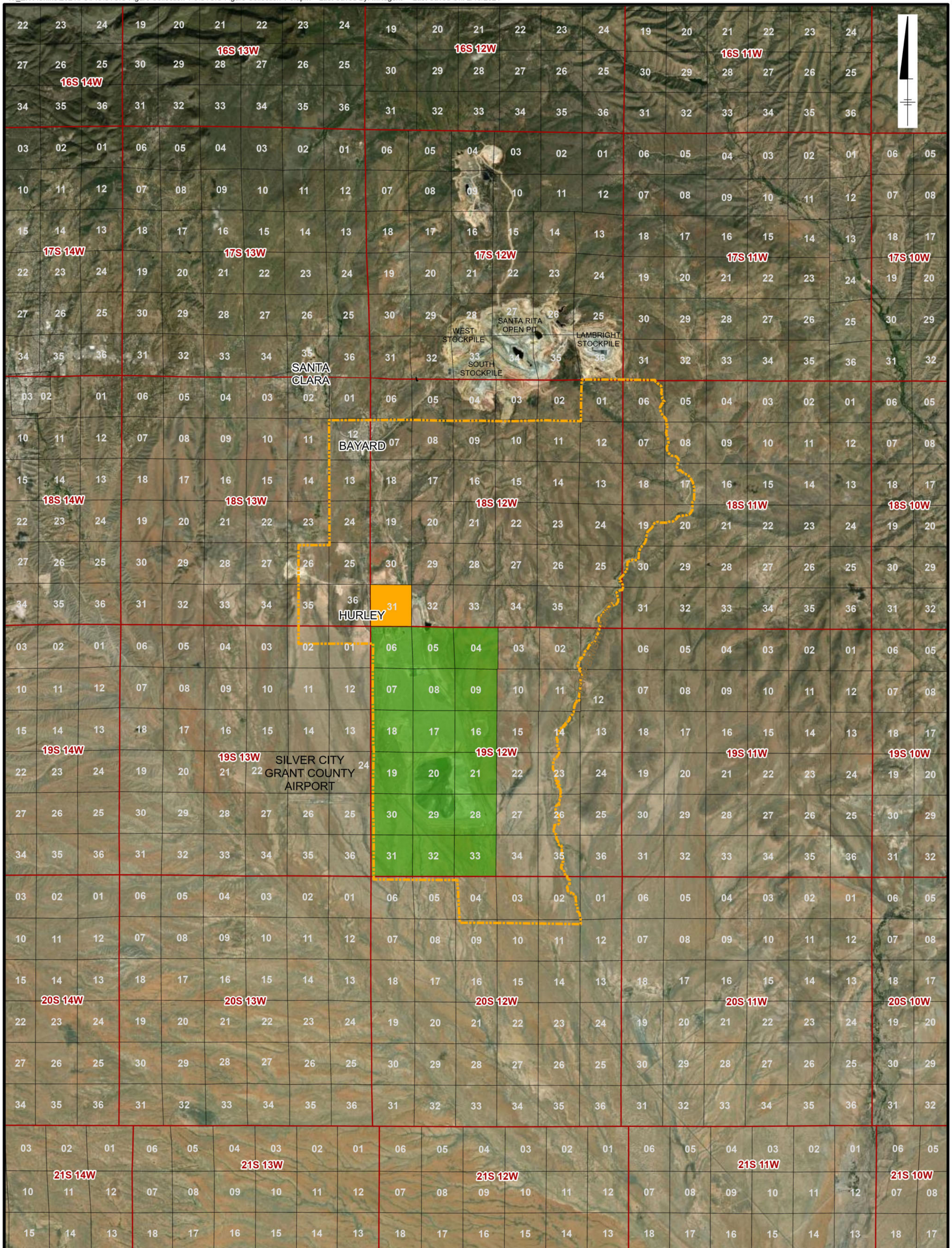
0 1.5 3 Miles
GRAPHIC SCALE

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILINGS SOILS IU FS

SITE OVERVIEW

ARCADIS

FIGURE
1-1



LEGEND:

- STSIU Study Boundary
- Smelter Investigation Unit Section
- Tailing Impacted Soils Investigation Unit Sections
- Township-Range Boundaries
- Section Boundaries

Service Layer Credits: World Imagery: Earthstar Geographics

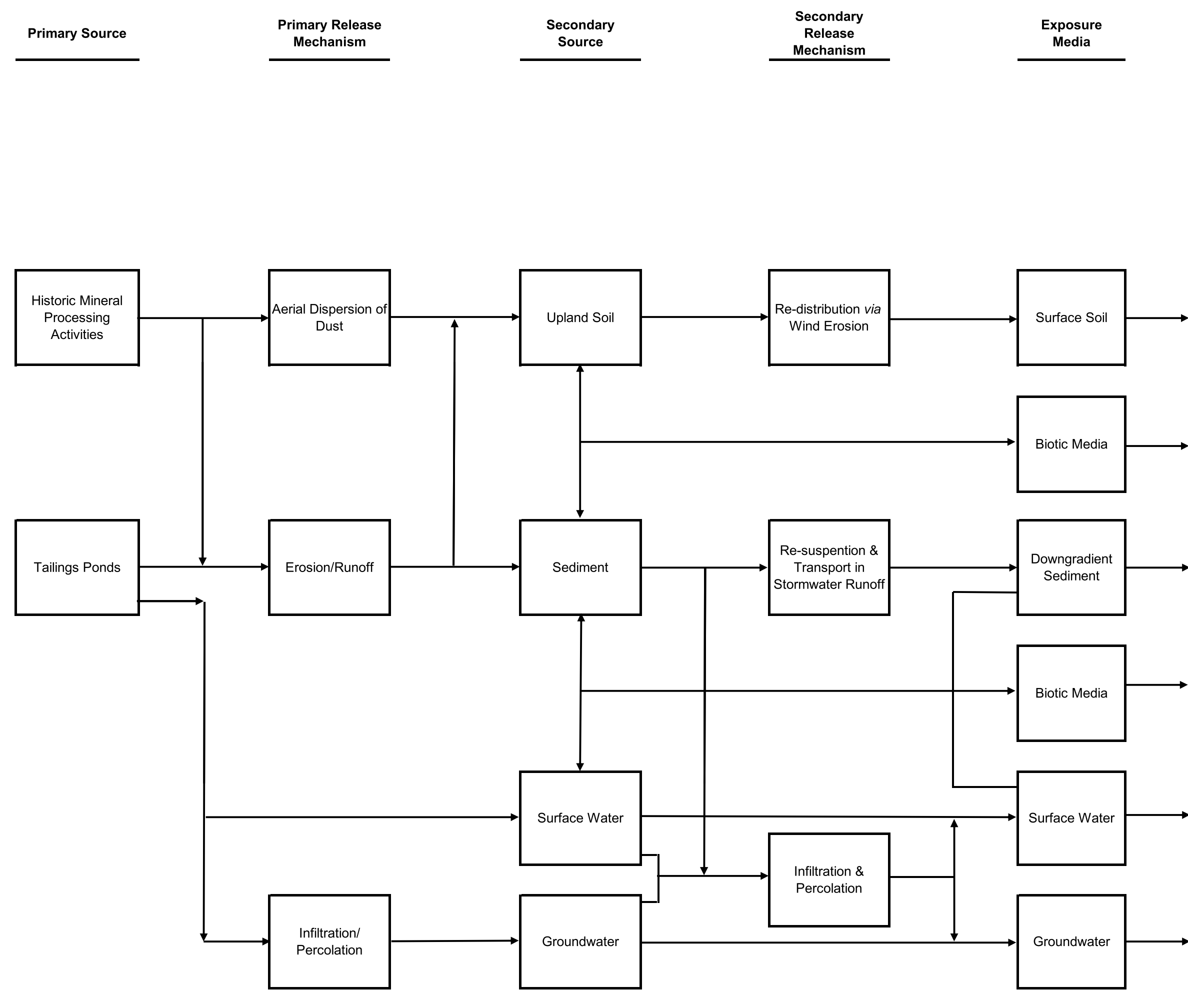
0 2 4 Miles
GRAPHIC SCALE

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILINGS SOILS IU FS

STSIU STUDY BOUNDARY AND INVESTIGATION UNITS

ARCADIS

FIGURE
2-1



Exposure Media	Exposure Route	Future Resident	Trespasser/Recreators	Construction Workers	Ecological - Avian	Ecological - Mammals	Ecological - Plants	Ecological - Aquatic Life
Surface Soil	Direct Contact	●	●	●	●	●	●	o
	Ingestion	●	●	●	●	●	o	o
	Inhalation	●	●	●	o	o	o	o
Biotic Media	Direct Contact	o	o	o	o	o	o	o
	Ingestion	o	o	o	●	●	o	o
Downgradient Sediment	Direct Contact	o	o	o	o	o	o	o
	Ingestion	o	o	o	o	o	o	o
	Inhalation	o	o	o	o	o	o	o
Biotic Media	Direct Contact	o	o	o	o	o	o	o
	Ingestion	o	o	o	●	●	o	o
Surface Water	Direct Contact	●	●	●	●	●	o	●
	Ingestion	●	●	●	●	●	o	o
Groundwater	Direct Contact	o	o	o	o	o	o	o
	Ingestion	o	o	o	o	o	o	o

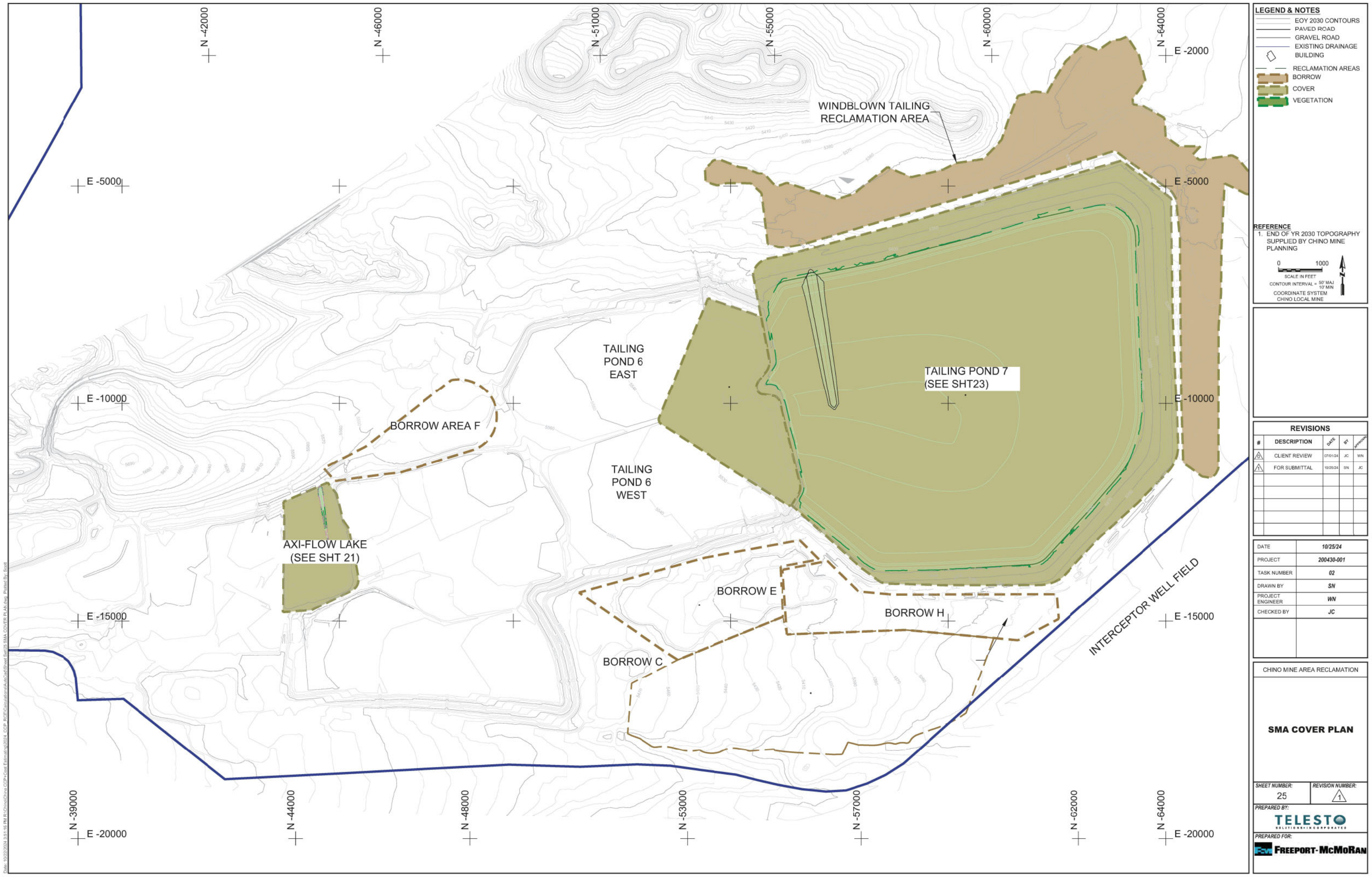
● Potentially complete exposure pathway
o Incomplete, or potentially complete but considered insignificant exposure pathway

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILINGS SOILS IU FS

CONCEPTUAL SITE MODEL

ARCADIS

FIGURE **3-1**



NOTE:
1. THE BROWN AREA IS RECENT WINDBLOWN TAILING AREA AFFECTED BY TP-7 AND EXCLUDED FROM THIS FEASIBILITY STUDY

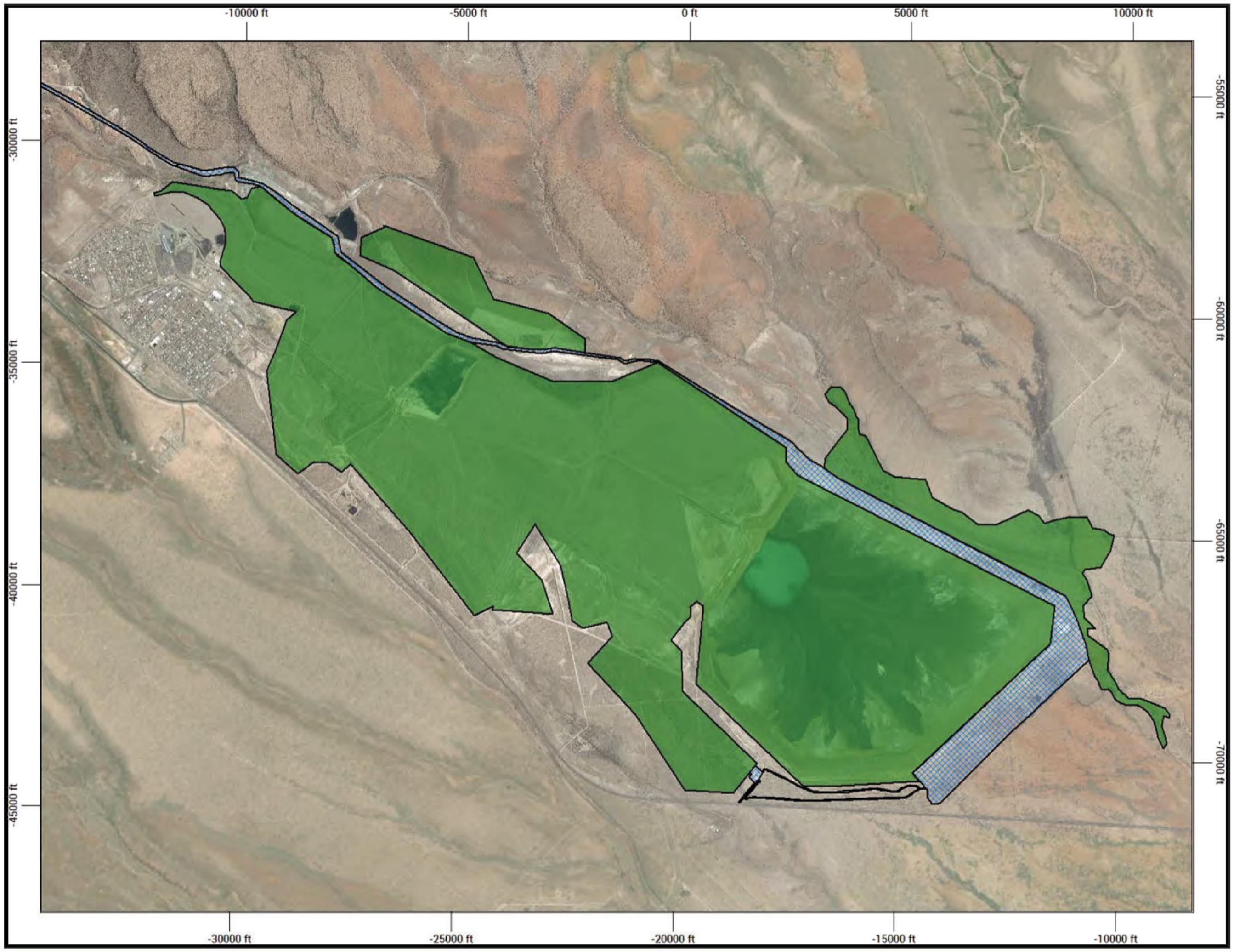
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILINGS SOILS IU FS

CURRENT EXTENT OF WINDBLOWN TAILINGS ASSOCIATED WITH TP-7 AND INCLUDED UNDER THE CLOSURE-CLOSEOUT PLAN FOR TP-7

ARCADIS

FIGURE 3-2a

Last Saved By: MNugent
T:_ENV\Chino\2024\FS\Pro\STSIU Figure Collection 1-3\STSIU Figure Collection 1-3.aprx 11/19/2024 4:57 PM



NOTES:

AERIAL IMAGERY: CHINO MINES SATELLITE SURVEY, APRIL 21, 2024

WILDLIFE

WATER MANAGEMENT

N

0 3000

SCALE IN FEET

COORDINATE SYSTEM
CHINO LOCAL MINE

FIGURE 12
SMA PMLU

PREPARED BY:

TELESTO SOLUTIONS INCORPORATED

PREPARED FOR:

FREEPORT-McMoRAN

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILINGS SOILS IU FS

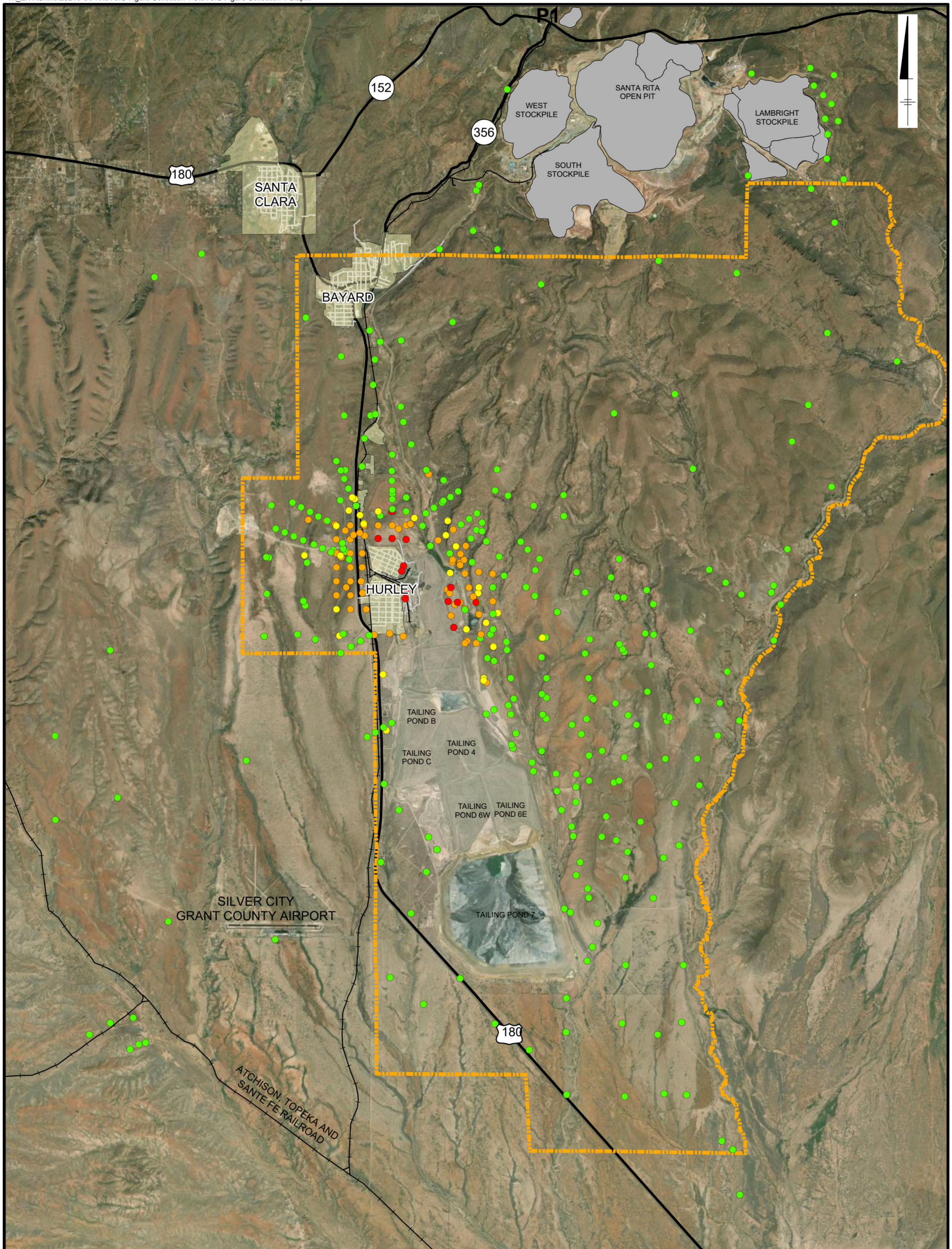
CLOSURE CLOSEOUT PLAN'S DESIGNATION OF AREAS FOR WILDLIFE AND WATER MANAGEMENT THAT INCLUDES RECENT WINDBLOWN TAILING AREA

ARCADIS

FIGURE
3-2b

Last Saved By: MNugent
T:_ENV\Chino\2024\FS\Pro\STSIU Figure Collection 1-3\STSIU Figure Collection 1-3.aprx 11/19/2024 4:57 PM

OFFICE: LAKEWOOD DB: MLM TM: MB PM: AT
PROJECT# B0063543.0000
T:_ENV\Chino\2024\FS\Pro\STSIU Figure Collection 1-3\STSIU Figure Collection 1-3.aprx



LEGEND:

Copper Concentration (mg/kg)

- <1,100
- 1,100 - 1,600
- 1,600 - 5,000
- >5,000

- Stockpiles
- Local City
- STSIU Boundary

Service Layer Credits: World Imagery: Earthstar Geographics

0 6,000 12,000 Feet
GRAPHIC SCALE

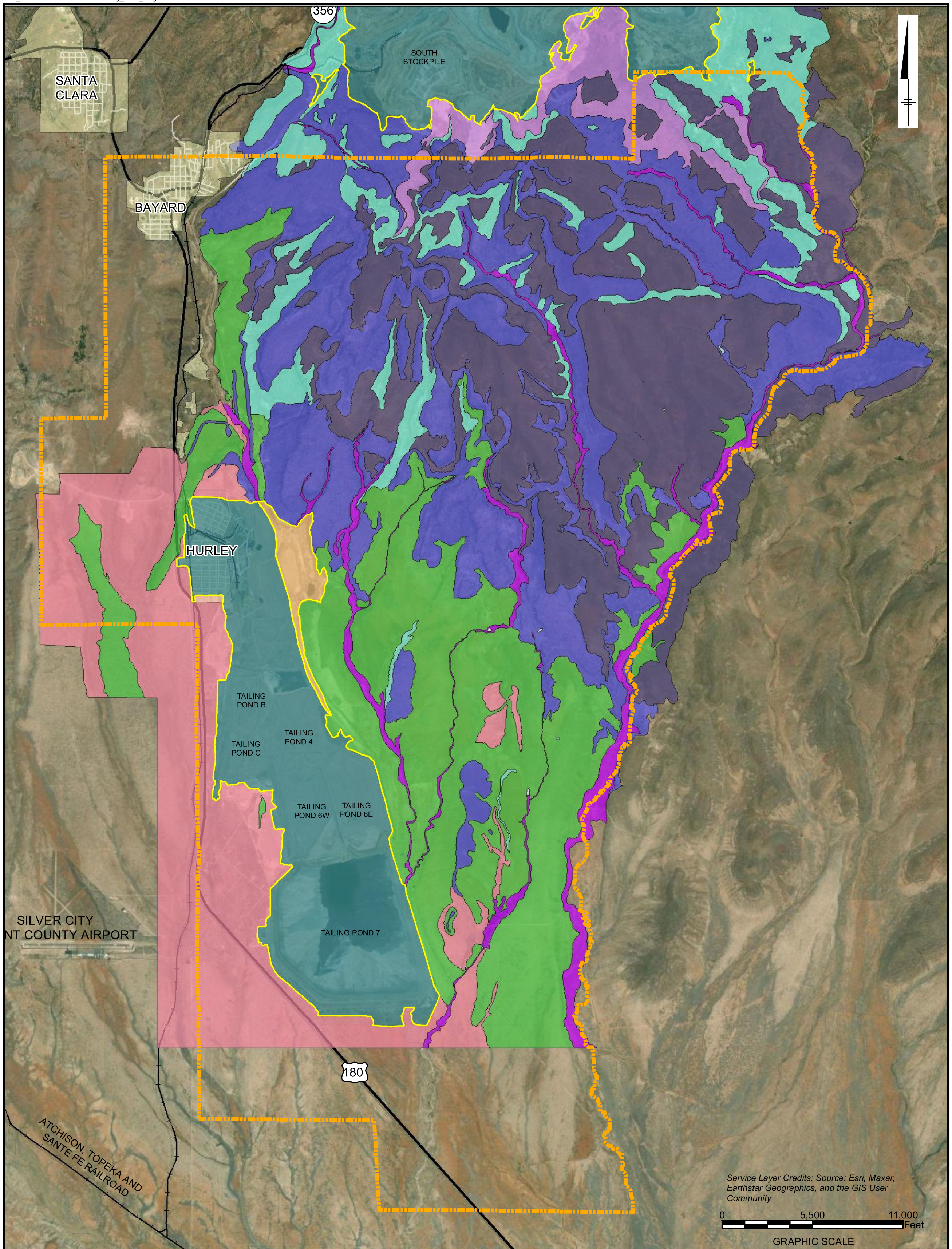
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILINGS SOILS IU FS

COPPER SAMPLE LOCATIONS AND CONCENTRATIONS IN SOIL FOR PRE-IRA SAMPLES

ARCADIS

FIGURE
3-2c

OFFICE: LAKEWOOD DB: MLM TM: MB PM: AT
PROJECT# B0063543.0000
T:_ENV\Chino\2022\MXD\FS\Fig_3-03_VegetationAlliances.mxd



LEGEND:

STSIU Boundary

Mine Facilities Alliances

- Mine Facilities/Other
- Mine Facilities/Urban

Vegetation Alliances

- Alligator Juniper-Oak Woodland Alliance
- Alligator Juniper-Oak/Grama Woodland Alliance
- Fluvial Forest and Shrubland Alliance
- Mesquite/Mixed Grama Shrubland Alliance
- Mixed-Grama Herbacious Alliance
- Mountain Mahogany Shrubland Alliance
- Not Classified
- Pondrosa Pine-Oak Forest Alliance

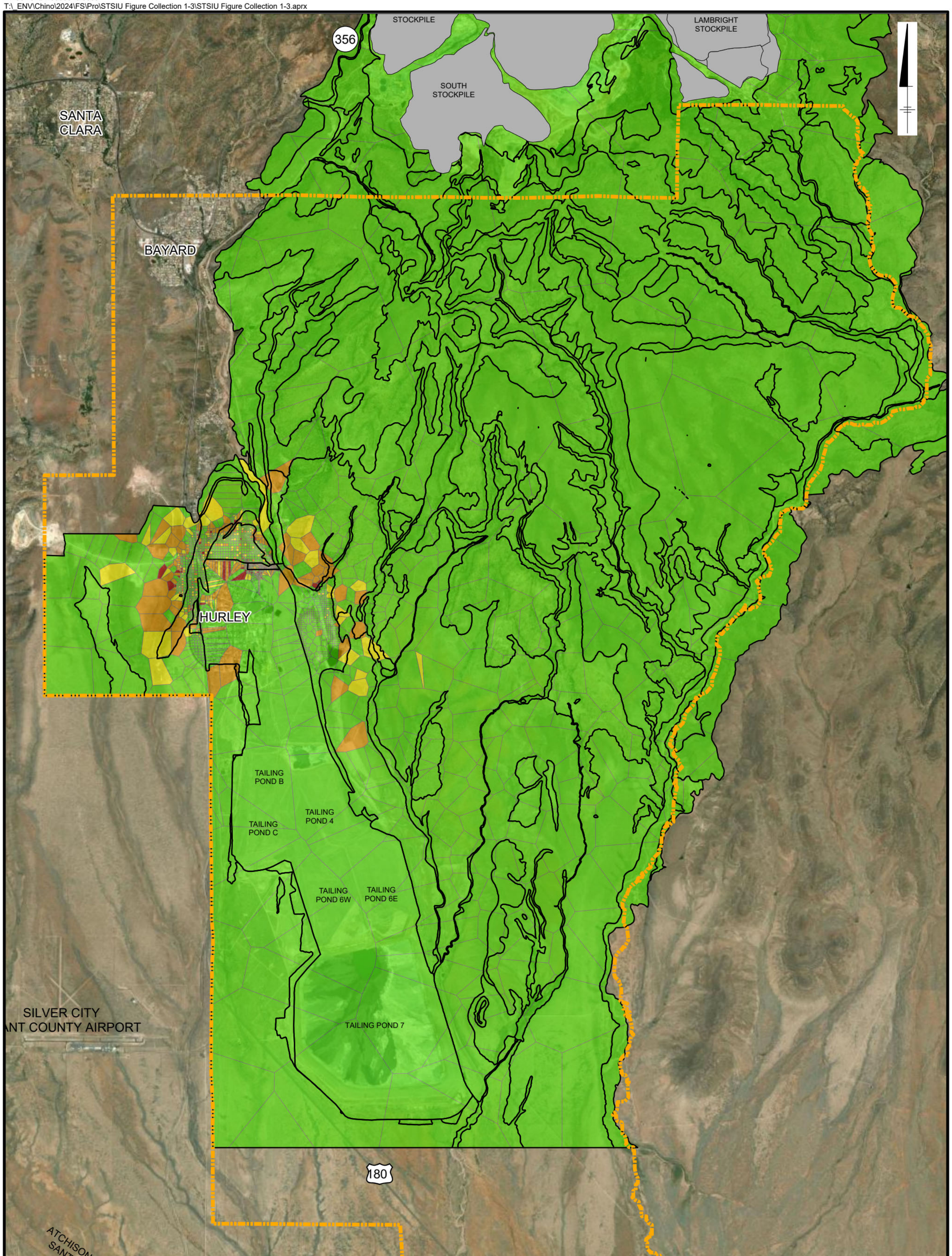
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILINGS SOILS IU FS

VEGETATION ALLIANCES

ARCADIS

FIGURE
3-3

OFFICE: LAKEWOOD DB: MLM TM: MB PM: AT
PROJECT# B0063543.0000
T:_ENV\Chino\2024\FS\Pro\STSIU Figure Collection 1-3\STSIU Figure Collection 1-3.aprx



LEGEND:

Copper Concentration (mg/kg)
- < 1,100
- 1,100 - 1,600
- 1,600 - 3,000
- > 3,000

- Vegetation Alliance Polygons
- STSIU Boundary
- Stockpiles

Service Layer Credits: World Imagery: Earthstar Geographics

0 5,000 10,000 Feet
GRAPHIC SCALE

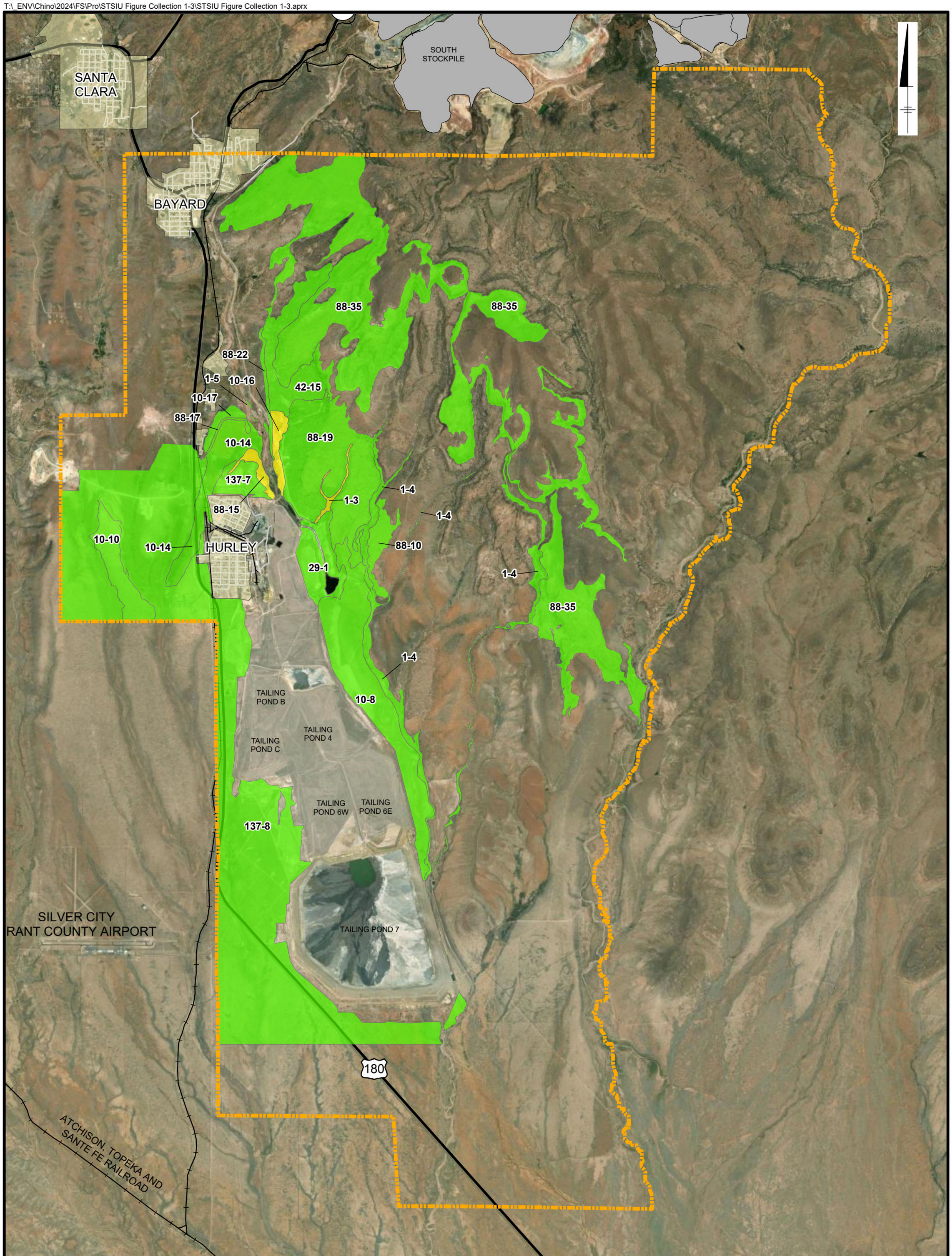
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILINGS SOILS IU FS

COPPER THIESSENS WITH VEGETATION BOUNDARIES

ARCADIS

FIGURE
3-4

OFFICE: LAKEWOOD DB: MLM TM: MB PM: AT
PROJECT# B0063543.0000
T:_ENV\Chino\2024\FS\Pro\STSIU Figure Collection 1-3\STSIU Figure Collection 1-3.aprx



LEGEND:

95 UCL Copper Concentration (mg/kg)

- <1,100
- 1,100 - 1,600

- STSIU Boundary
- Local City
- Stockpiles

Note:
1. Unshaded areas represent polygons with a maximum copper concentration <1,100 mg/kg and were not evaluated for UCLs; see Figure 3-3 for full set of alliance polygons.
2. Service Layer Credits: World Imagery: Earthstar Geographics

0 5,500 11,000 Feet
GRAPHIC SCALE

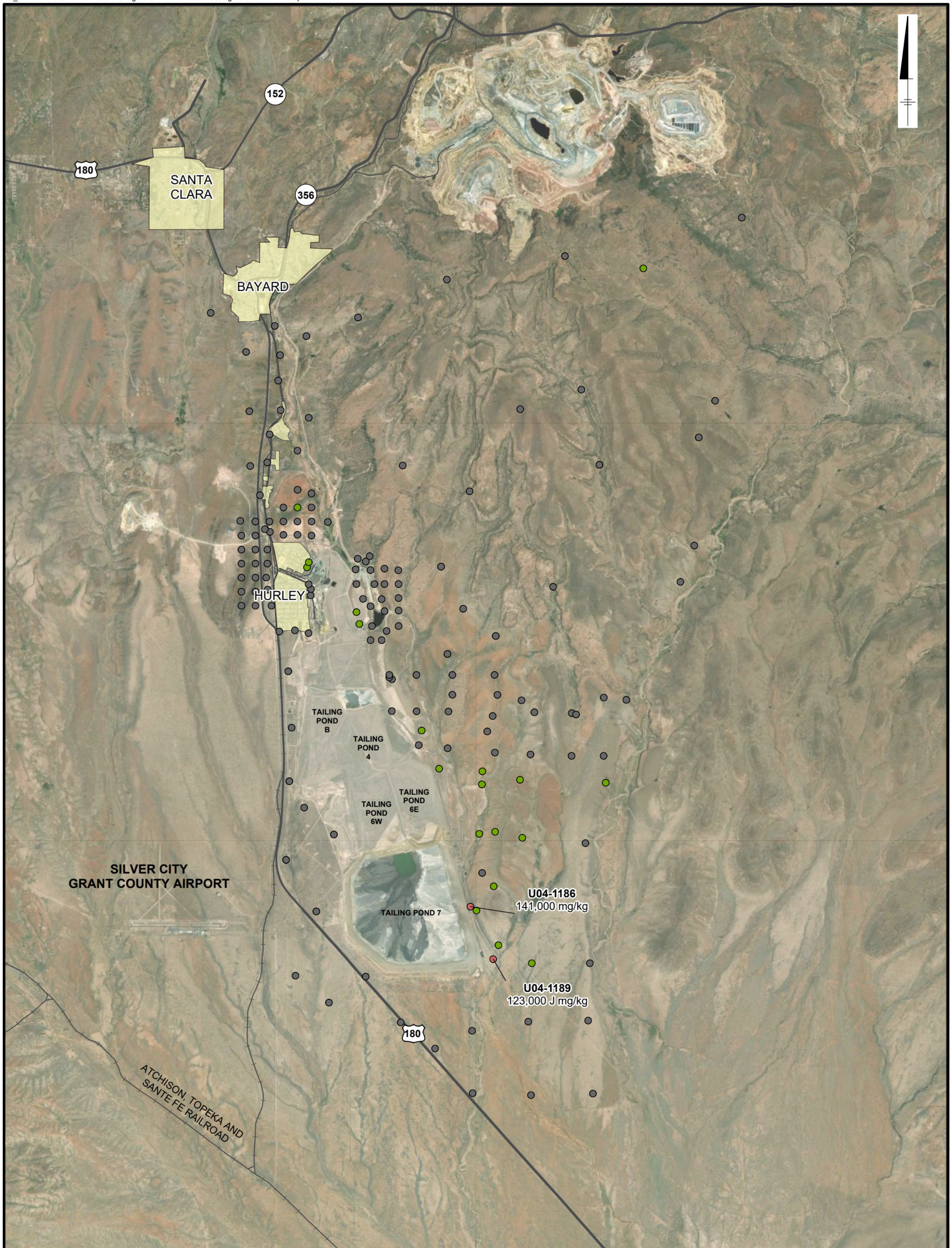
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILINGS SOILS IU FS

95 UCL AREA-WEIGHTED AVERAGE COPPER CONCENTRATIONS ACROSS VEGETATION ALLIANCES

ARCADIS

FIGURE
3-5

OFFICE: LAKEWOOD DB: MLM TM: MB PM: AT
PROJECT# B0063543.0000
T:_ENV\Chino\2024\FS\Pro\STSIU Figure Collection 1-3\STSIU Figure Collection 1-3.aprx



LEGEND:

Iron Concentration (mg/kg)

- <40,000
- 40,000 - 70,000
- 70,000 - 100,000
- >100,000

Local Cities
Railroad
Major Roads

Service Layer Credits: World Imagery: Earthstar Geographics

0 1 2 Miles
GRAPHIC SCALE

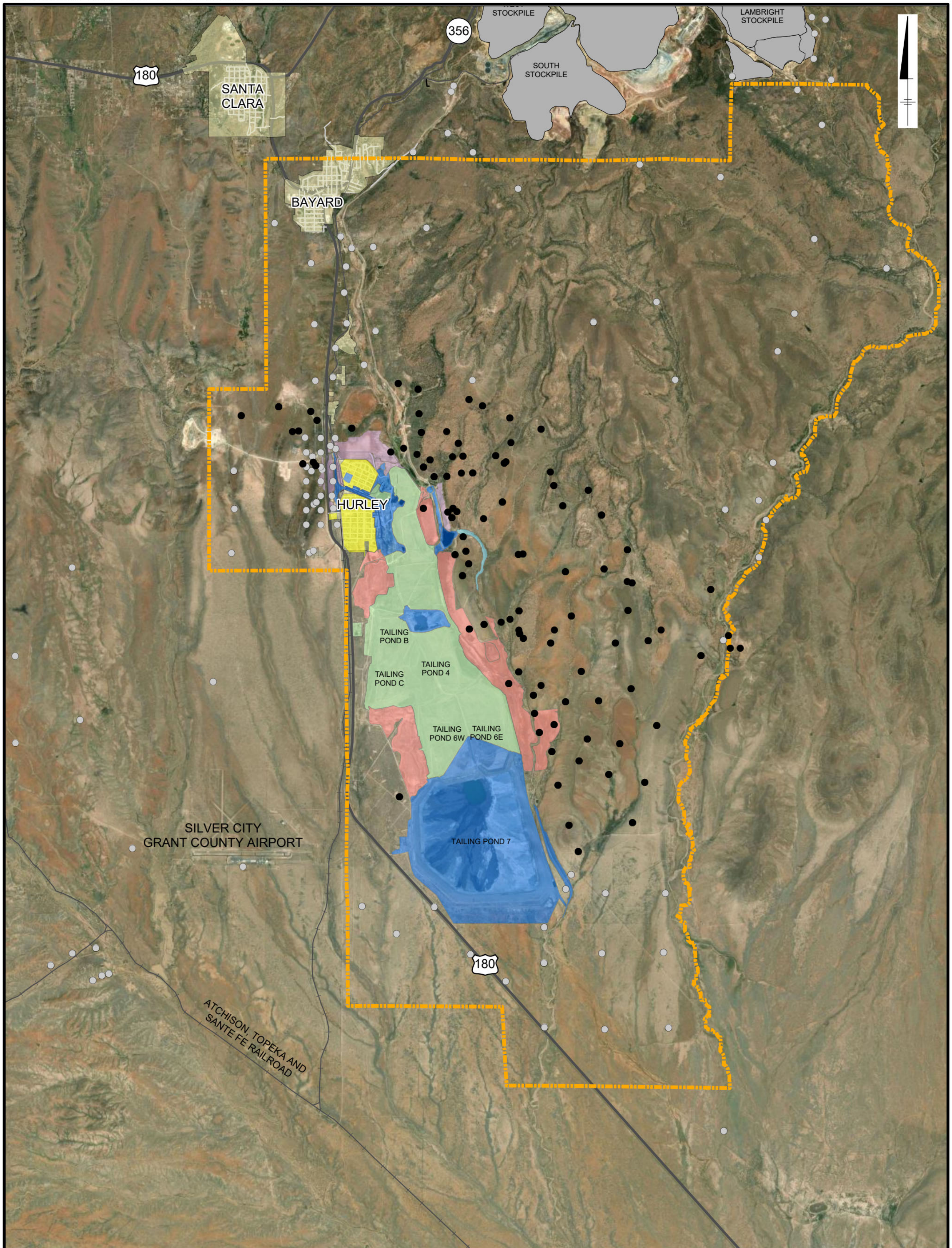
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILINGS SOILS IU FS

STSIU SAMPLE LOCATIONS AND IRON CONCENTRATIONS IN SOILS

ARCADIS

FIGURE
3-6

OFFICE: LAKEWOOD DB: MLM TM: MB PM: AT
PROJECT# B0063543.0000
T:_ENV\Chino\2024\FS\Pro\STSIU Figure Collection 1-3\STSIU Figure Collection 1-3.aprx



LEGEND:

- Pre-White Rain Sample Location
- Post-White Rain Sample Location
- STSIU Boundary
- Stockpiles
- Local City
- Borrow Pit
- CCP
- Diversion Project
- Hurley Soils IU
- IRAs
- Ops Reclamation

Note:
1. Rangeland condition was determined using the observed apparent trend (OAT).

Service Layer Credits: World Imagery: Earthstar Geographics

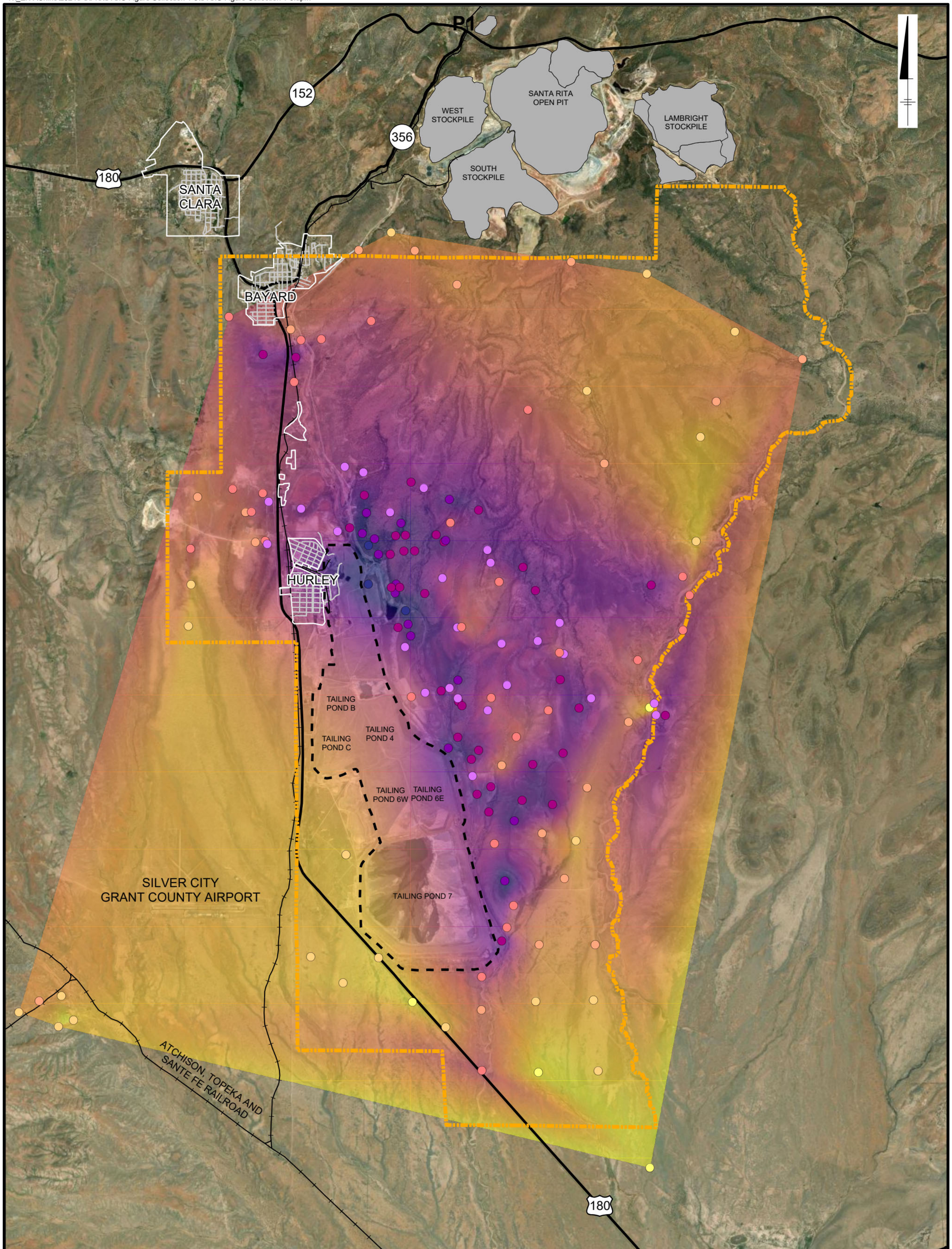
0 6,000 12,000 Feet
GRAPHIC SCALE

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILINGS SOILS IU FS

PRE- AND POST-WHITE RAIN pCu SAMPLE LOCATIONS

ARCADIS

FIGURE 3-7



LEGEND:

pCu Samples
- >10
- 9 - 10
- 8 - 9
- 7 - 8
- 6 - 7
- 5 -6
- 4 - 5
- 3 - 4
- <3

Natural Neighbor Interpolation
- 10.1
- 2.7
- Stockpiles
- STSIU Boundary
- Smelter Tailings Boundary

0 5,000 10,000 Feet
GRAPHIC SCALE

Service Layer Credits: World Imagery: Earthstar Geographics

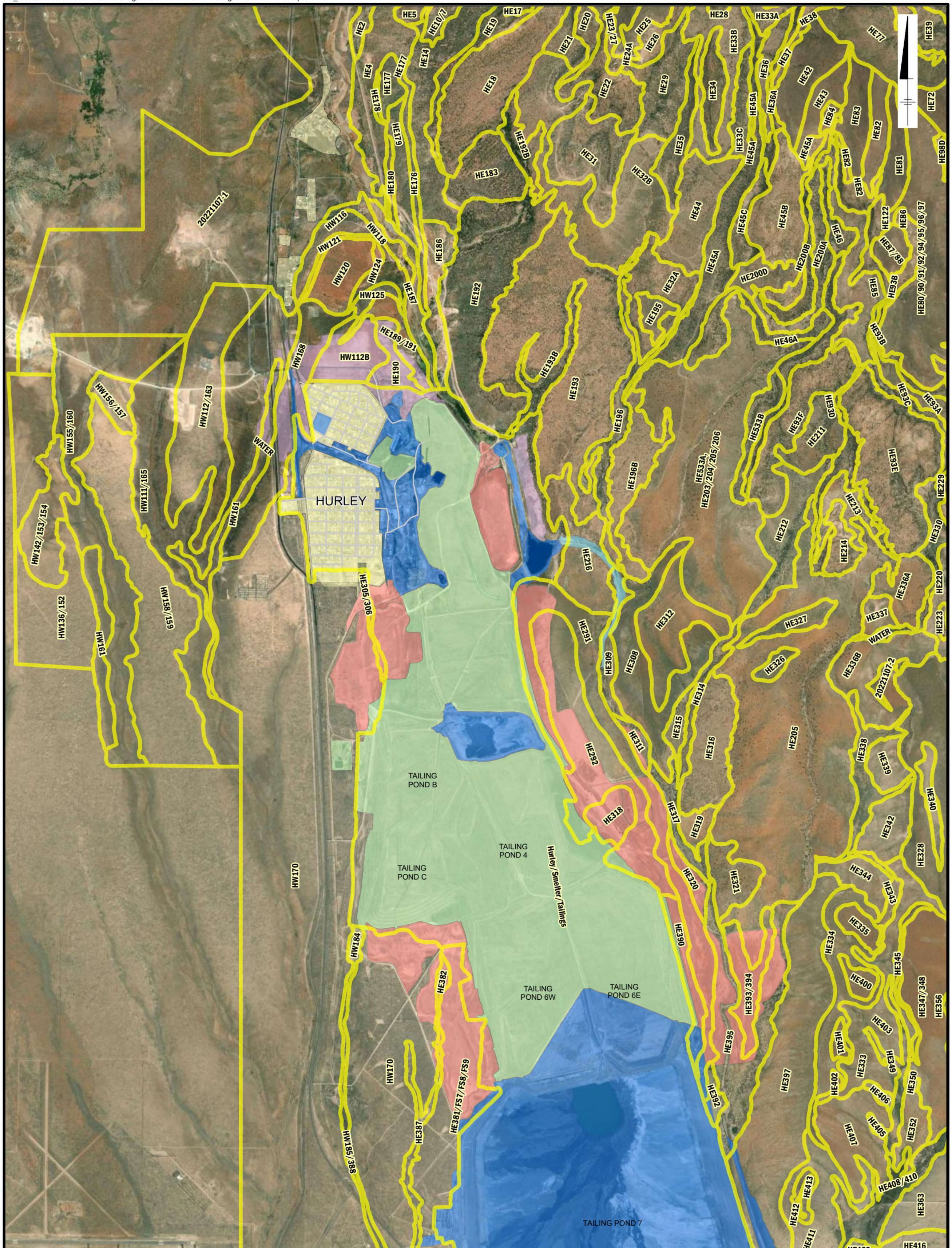
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILINGS SOILS IU FS

pCu SAMPLE RESULTS AND NATURAL NEIGHBOR INTERPOLATION

ARCADIS

FIGURE 3-8

OFFICE: LAKEWOOD DB: MLM TM: MB PM: AT
PROJECT# B0063543.0000
T:_ENV\Chino\2024\FS\Pro\STSIU Figure Collection 1-3\STSIU Figure Collection 1-3.aprx



LEGEND:

Rangeland Polygons (Exposure Unit for pCu)
Town Roads
Stockpiles
Local City

Reclaimed Areas/Borrow Areas

Borrow Pit
CCP
Diversion Project
Hurley Soils IU
IRAs
Operations

Note:
1. Service Layer Credits: World Imagery: Maxar.
2. See abbreviations in report.

0 3,000 6,000 Feet
GRAPHIC SCALE

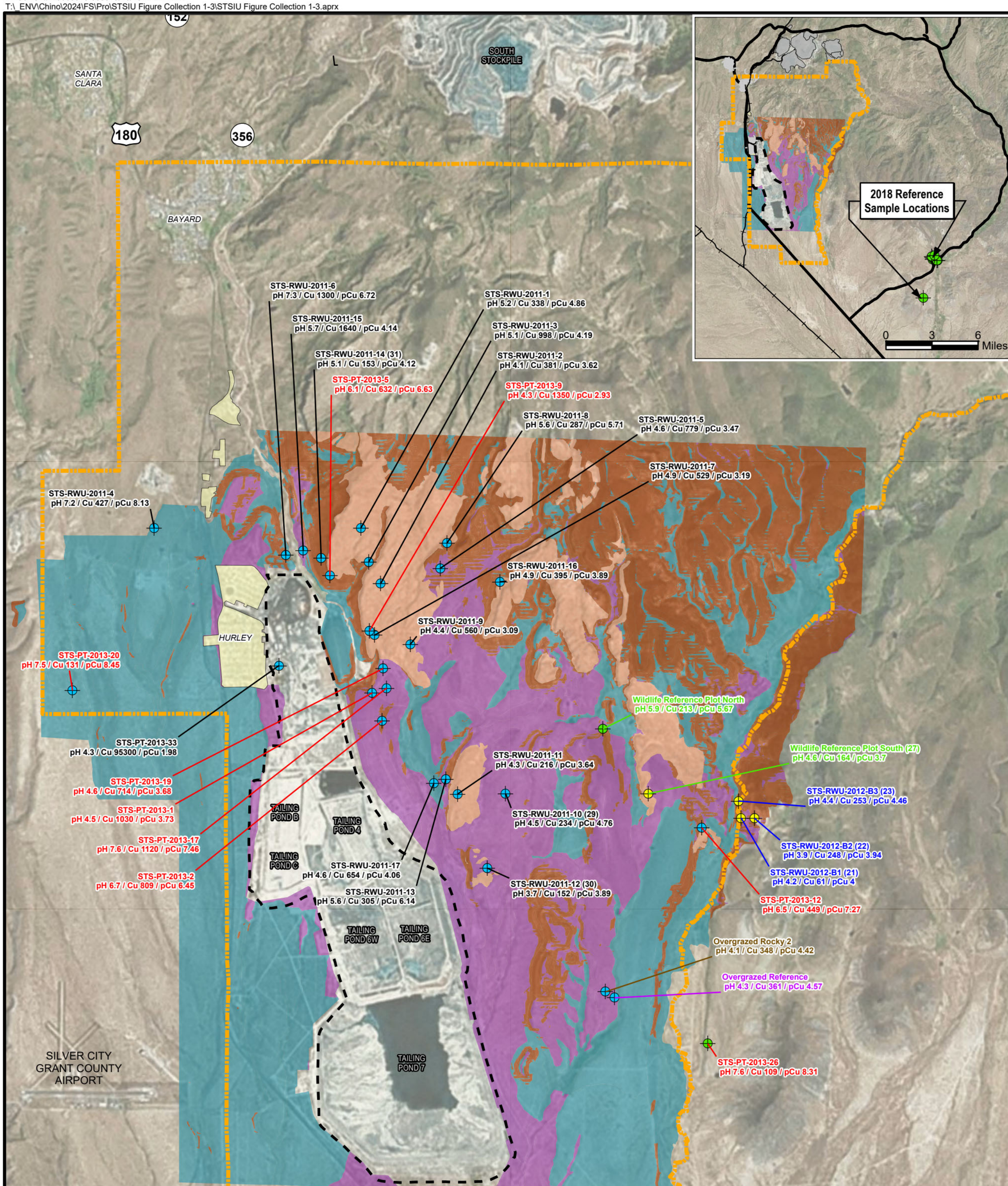
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILINGS SOILS IU FS

RANGELAND POLYGONS

ARCADIS

FIGURE
3-9

OFFICE: LAKEWOOD DB:MEB TM: MB PM: AT
PROJECT# B0063543.0000 9/16/2024 1:42 PM
T:_ENV\Chino\2024\FS\Pro\STSIU Figure Collection 1-3\STSIU Figure Collection 1-3.aprx



Notes:
Black labels denote sites surveyed for vegetation only in 2011
Brown labels denote sites never sampled for vegetation
Blue labels denote sites sampled for vegetation only in 2012
Red labels denote sites sampled for vegetation only in 2014
Green labels denote sites sampled for vegetation in 2011, 2014 and 2018
Purple labels denote sites sampled for vegetation only in 2018
Soil samples taken at all locations in 2013 or 2018
Location labels with a number in parenthesis are for locations also sampled in the laboratory phytotoxicity study and indicate the X in that study's STS-PT-2013-X label.
Copper (Cu) units are mg/kg; pH and pCu units are s.u.

LEGEND:
- Site vegetation survey and soil sampling location
- De minimus vegetation survey and soil sampling location
- Reference vegetation survey and soil sampling location
- STSIU Boundary
- Smelter Tailings Boundary

Soil Category
- Flat Granular Soil
- Flat Rocky Soil
- Slope > 13%
- Bedrock

Service Layer Credits: World Imagery (Clarity): Source: Esri, Maxar, Earthstar Geographics, IGN, and the GIS User Community

0 5,000 10,000 Feet
GRAPHIC SCALE

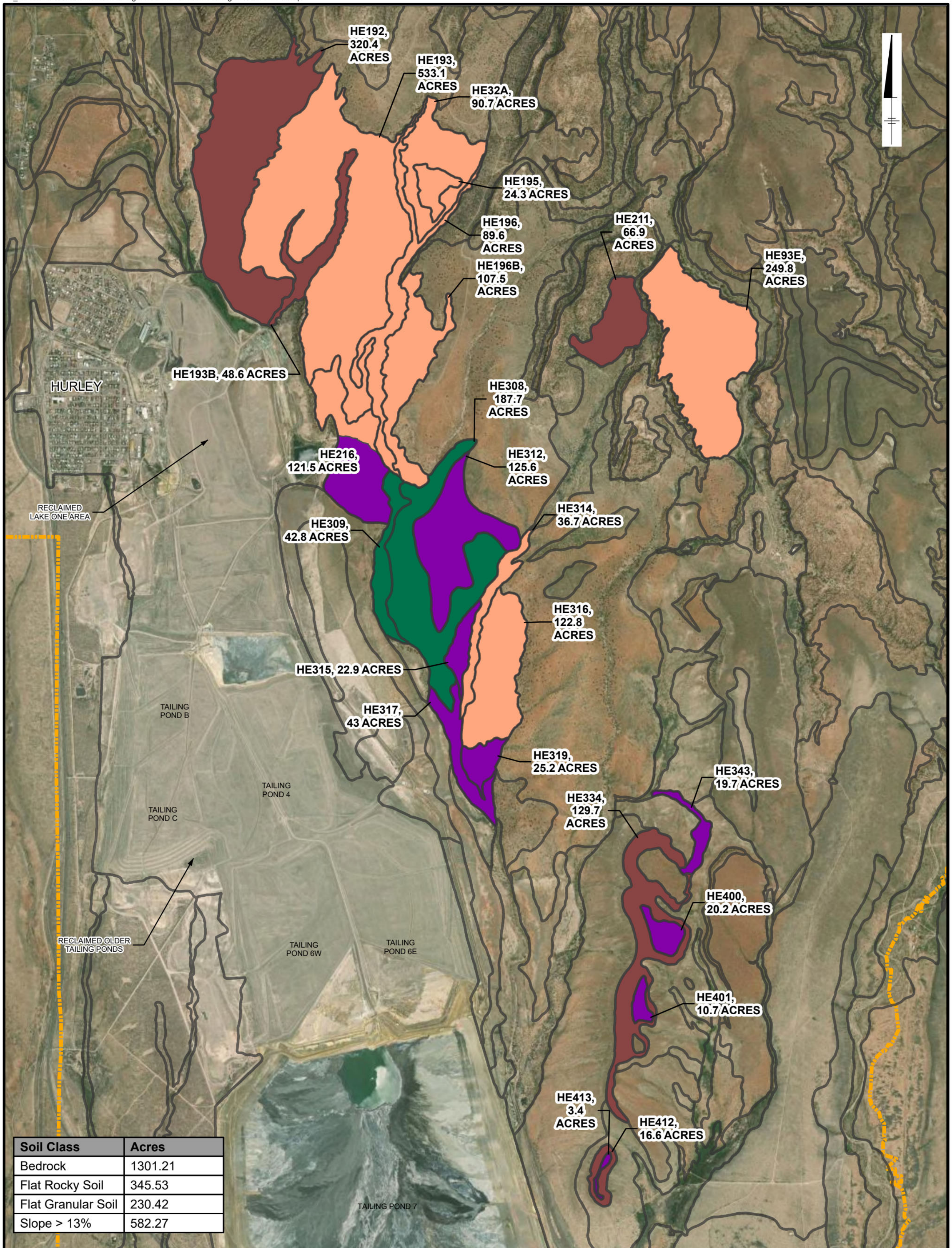
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILINGS SOILS IU FS

VEGETATION SAMPLING LOCATIONS ON SOIL CATEGORY MAP

ARCADIS

FIGURE
3-10

OFFICE: LAKEWOOD DB: MLM TM: MB PM: AT
PROJECT# B0063543.0000
T:_ENV\Chino\2024\FS\Pro\STSIU Figure Collection 1-3\STSIU Figure Collection 1-3.aprx



Soil Class	Acres
Bedrock	1301.21
Flat Rocky Soil	345.53
Flat Granular Soil	230.42
Slope > 13%	582.27

LEGEND:

Soil Class

- Bedrock < 5.0 pCu & Cu > 327
- Flat Rocky Soil < 5.0 pCu & Cu > 327
- Slope greater than 13% < 5.0 pCu & Cu > 327
- Flat Granular Soil < 5.0 pCu & Cu > 327
- STSIU Boundary

Notes:
1. Service Layer Credits: World Imagery: Maxar
2. Copper threshold is greater than 327 mg/kg regardless of soil category.

0 3,000 6,000 Feet
GRAPHIC SCALE

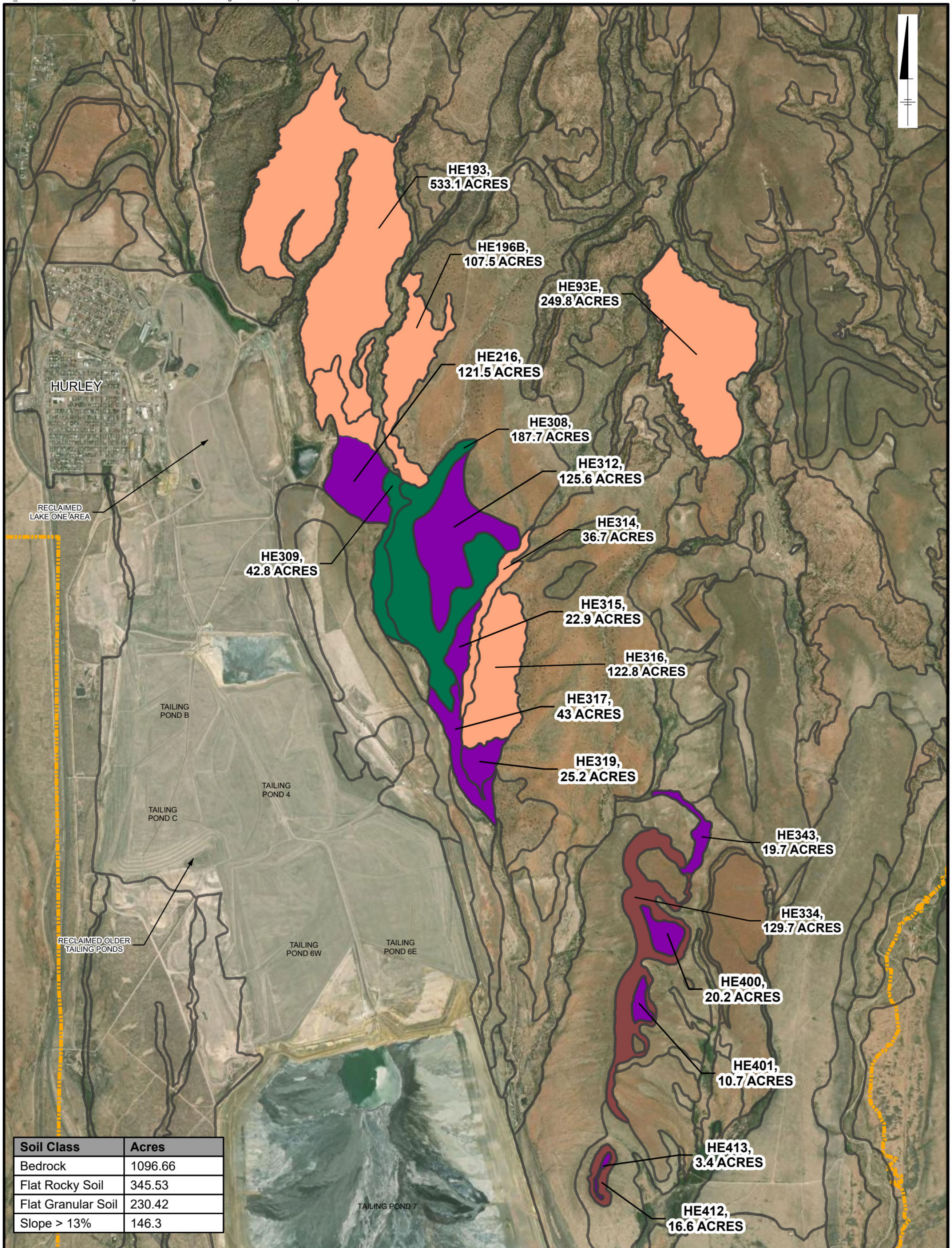
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILINGS SOILS IU FS

RANGELAND POLYGONS WITH pCu PRE-FS RAC BASED ON DATA POST-IRA

ARCADIS

FIGURE 3-11

OFFICE: LAKEWOOD DB: MLM TM: MB PM: AT
PROJECT# B0063543.0000
T:_ENV\Chino\2024\FS\Pro\STSIU Figure Collection 1-3\STSIU Figure Collection 1-3.aprx



Soil Class	Acres
Bedrock	1096.66
Flat Rocky Soil	345.53
Flat Granular Soil	230.42
Slope > 13%	146.3

LEGEND:

Soil Class

- Bedrock < 5.0 pCu & Cu > 327
- Flat Rocky Soil < 5.0 pCu & Cu > 327
- Slope greater than 13% < 5.0 pCu & Cu > 327
- Flat Granular Soil < 5.0 pCu & Cu > 327
- STSIU Boundary

Notes:
1. Service Layer Credits: World Imagery: Earthstar Geographics
2. Areas unacceptable have an unacceptable rangeland condition (unacceptable OAT score) or unacceptable wildlife habitat (e.g., unacceptable richness or unacceptable cover is considered unacceptable wildlife habitat).
3. Copper threshold is greater than 327 mg/kg regardless of soil category.

0 3,000 6,000 Feet
GRAPHIC SCALE

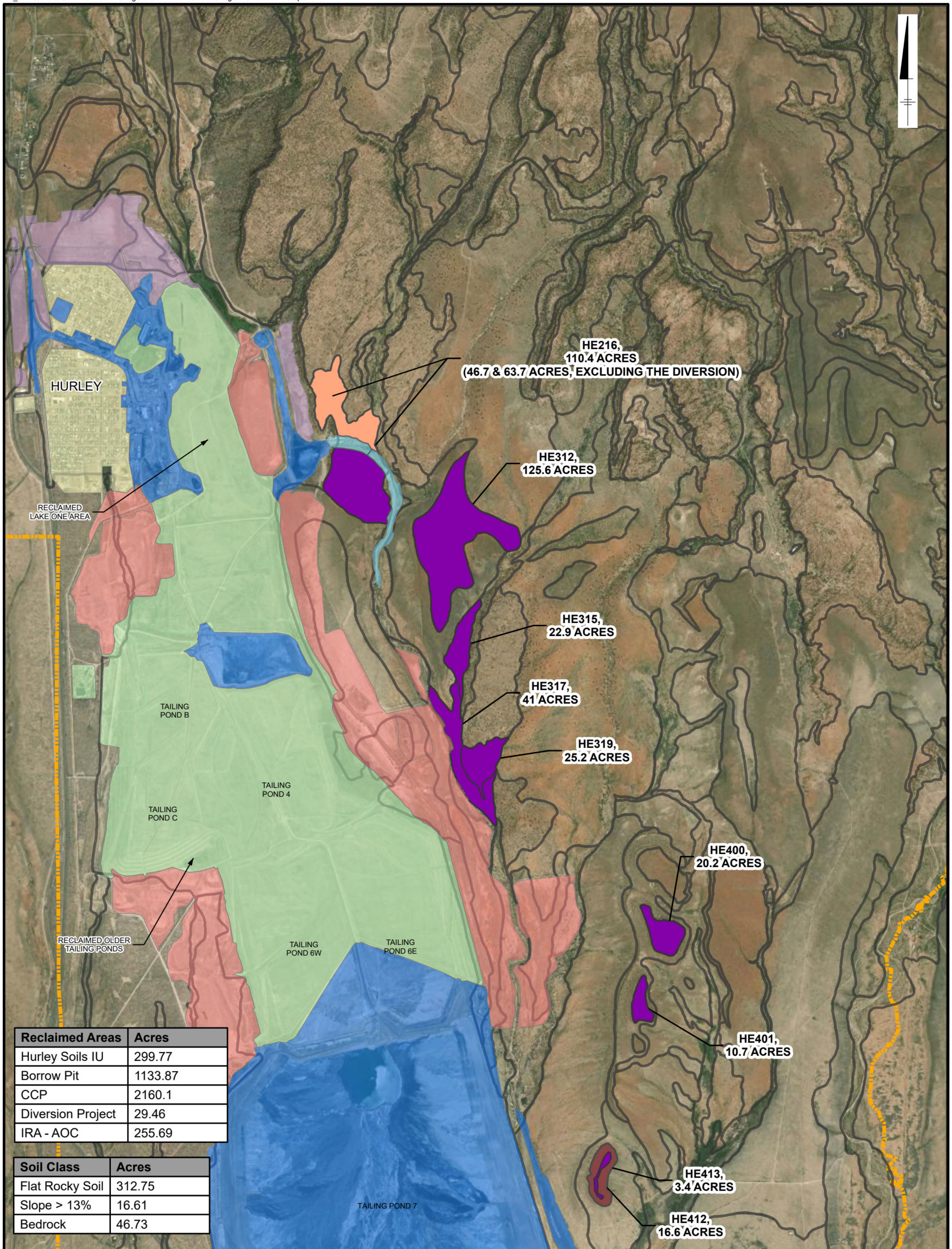
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILINGS SOILS IU FS

RANGELAND POLYGONS WITH pCu PRE-FS RAC ON DATA POST-IRA USING UNACCEPTABLE RANGELAND OR WILDLIFE HABITAT CRITERIA

ARCADIS

FIGURE
3-12

OFFICE: LAKEWOOD DB: MLM TM: MB PM: AT
PROJECT# B0063543.0000
T:_ENV\Chino\2024\FS\Pro\STSIU Figure Collection 1-3\STSIU Figure Collection 1-3.aprx



Reclaimed Areas	Acres
Hurley Soils IU	299.77
Borrow Pit	1133.87
CCP	2160.1
Diversion Project	29.46
IRA - AOC	255.69

Soil Class	Acres
Flat Rocky Soil	312.75
Slope > 13%	16.61
Bedrock	46.73

LEGEND:

Soil Class

- Bedrock < 4.4 pCu & Cu > 327
- Flat Rocky Soil < 4.98 pCu & Cu > 327
- Slope greater than 13% < 4.11 pCu & Cu > 327
- STSIU Boundary
- Borrow Pit
- CCP
- Diversion Project
- Hurley Soils IU
- IRAs
- Operations

Notes:
1. Service Layer Credits: World Imagery: Maxar
2. Areas unacceptable have an unacceptable rangeland condition (unacceptable OAT score) or unacceptable wildlife habitat (e.g., unacceptable richness or unacceptable cover is considered unacceptable wildlife habitat). Copper threshold is greater than 327 mg/kg regardless of soil category.
3. Flat Granular Soils have a PEL Criteria of 4.11, these rangeland units are no longer considered for remediation.

0 3,000 6,000 Feet
GRAPHIC SCALE

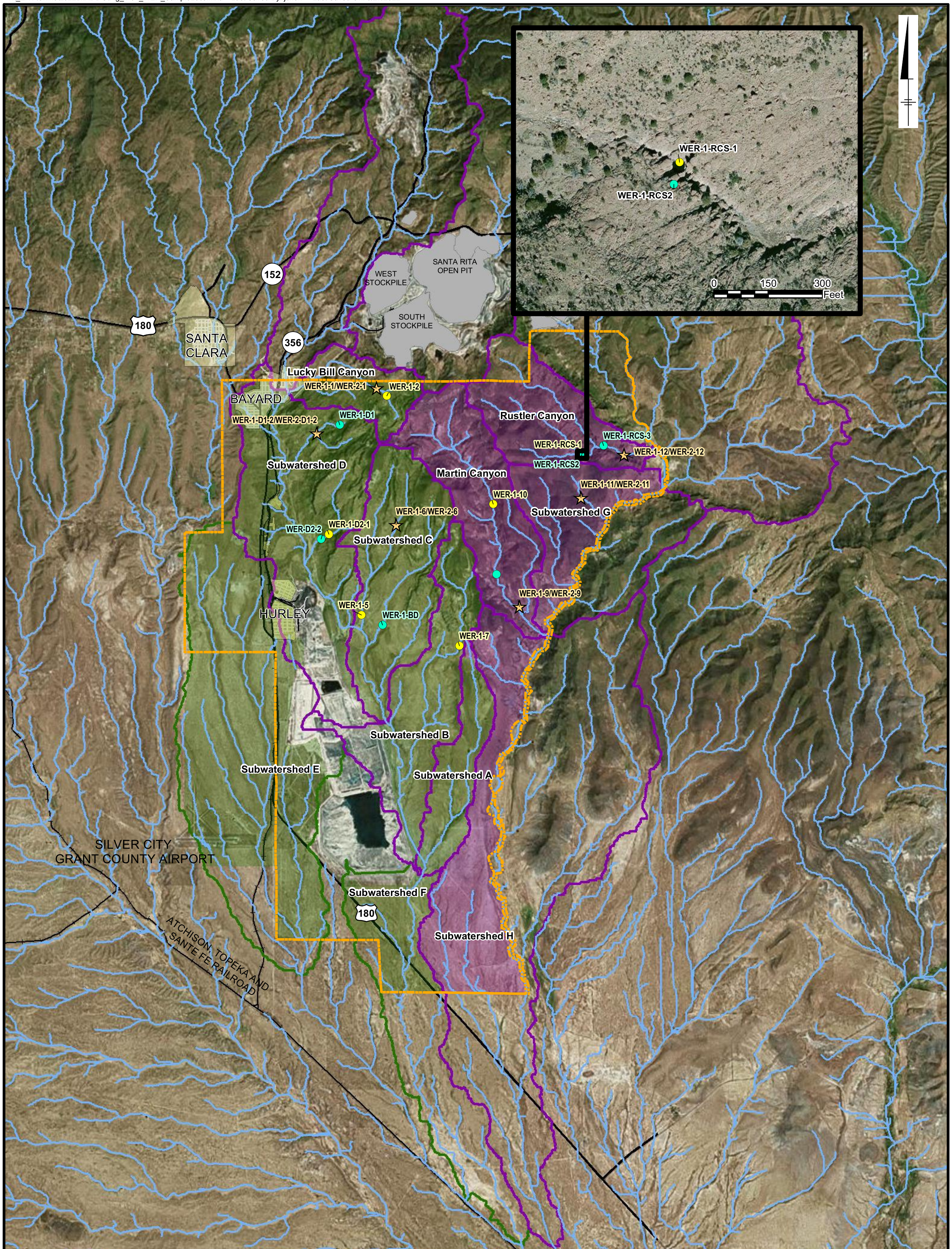
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILINGS SOILS IU FS

RANGELAND POLYGONS WITH pCu PRE-FS RAC ON DATA POST-IRA USING UNACCEPTABLE AND PEL CRITERIA

ARCADIS

FIGURE
3-13

AUTHOR: MB
PROJECT# B0063543.0000
T:_ENV\Chino\2022\MXD\FS\Fig_4-01_WER_SampleLocs.mxd Last Saved By: jchen Last Saved On: 9/27/2022



LEGEND:

- Analytical Sample Only
- Tox and Analytical Sample
- Tox and Analytical Sample (Sampled Twice)
- Lampbright Subwatershed Boundaries
- Lampbright Subwatersheds within AOC
- Hanover-Whitewater Subwatershed Boundaries
- Hanover-Whitwater Subwatersheds within AOC
- Stockpiles
- STSIU Study Boundary
- Local City
- Highway
- Railroad
- Town Roads
- Drainages

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

0 1.5 3 Miles
GRAPHIC SCALE

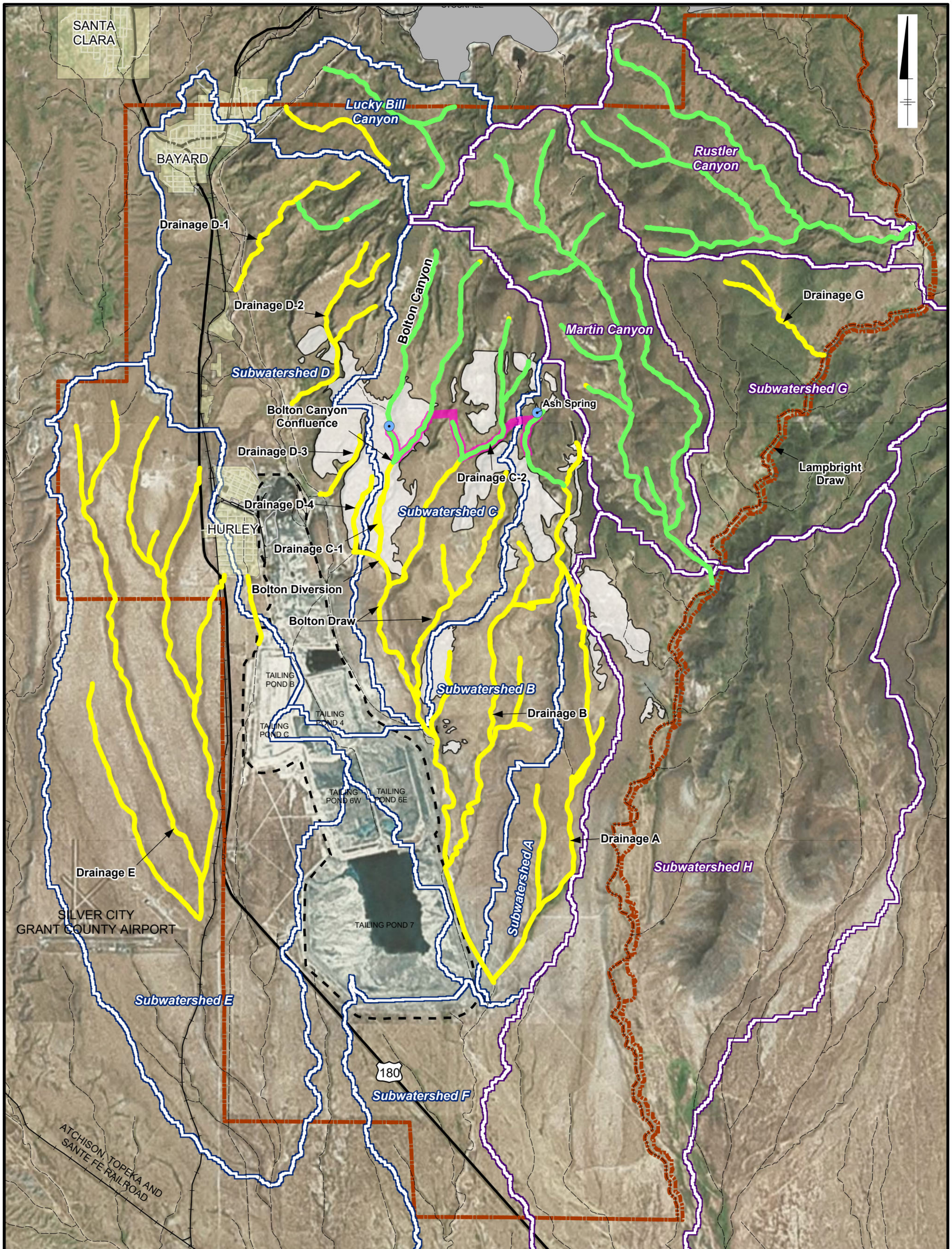
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILINGS SOILS IU FS

WER SAMPLE LOCATIONS

ARCADIS

FIGURE
4-1

OFFICE: LAKEWOOD DB: MLM TM: MB PM: AT
PROJECT# B0063543.0000
T:_ENV\Chino\2024\FS\Pro\STSIU Figure Collection 4-6\STSIU Figure Collection 4-6\2024_STSIU_Figures.aprx



LEGEND:

- Springs
- Lampbright Subwatershed Boundaries
- Hanover-Whitewater Subwatershed Boundaries
- STSIU Boundary
- Bedrock Extents
- USFWS Critical Habitat Transect
- Ephemeral Stream
- Non-Ephemeral Stream
- Smelter Tailings Boundary
- Local City
- Stockpiles

0 5,000 10,000 Feet
GRAPHIC SCALE

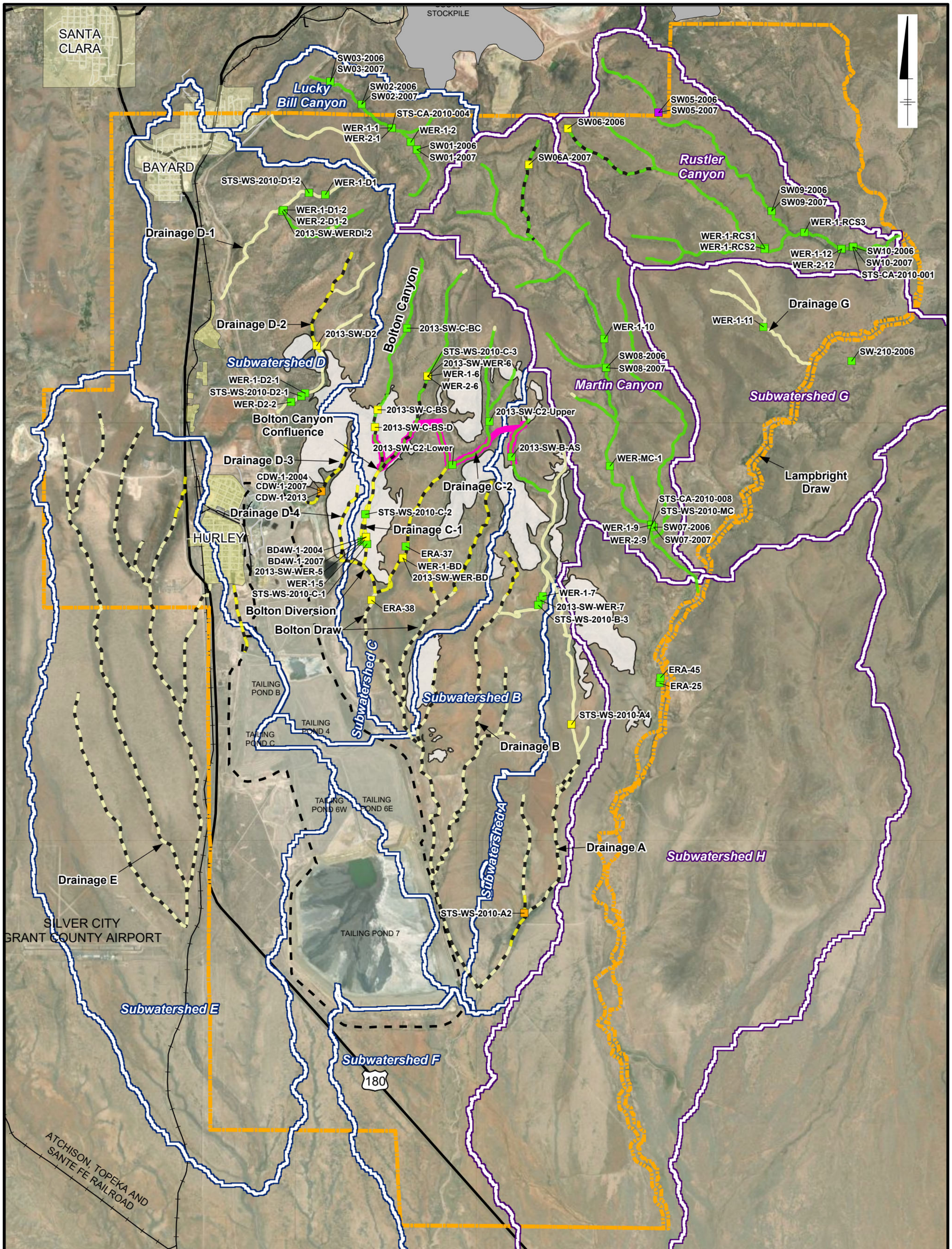
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILINGS SOILS IU FS

HYDROLOGIC CLASSIFICATIONS OF STSIU DRAINAGES

ARCADIS

FIGURE **4-2**

OFFICE: LAKEWOOD DB: MLM TM: MB PM: AT
PROJECT# B0063543.0000
T:_ENV\Chino\2024\FS\Pro\STSIU Figure Collection 4-6\STSIU Figure Collection 4-6\2024_STSIU_Figures.aprx



LEGEND:

Highest HQ Value
- < 1
- 1 - 3
- 3 - 7
- > 7

- USFWS Critical Habitat Transect
- Lampbright Subwatershed Boundaries
- Hanover-Whitewater Subwatershed Boundaries
- STSIU Boundary

- Non-Ephemeral/No Concerns
- Non-Ephemeral/Potential Concerns
- Ephemeral/No Concerns
- Ephemeral/Potential Concerns
- Ephemeral/Potential Concerns but Limited Potential for Pools

Notes:
1. Service Layer Credits: World Imagery: Earthstar Geographics
2. Multiple samples may have been collected at the locations, and to reference the Section 4 tables for results by date.

0 5,000 10,000 Feet
GRAPHIC SCALE

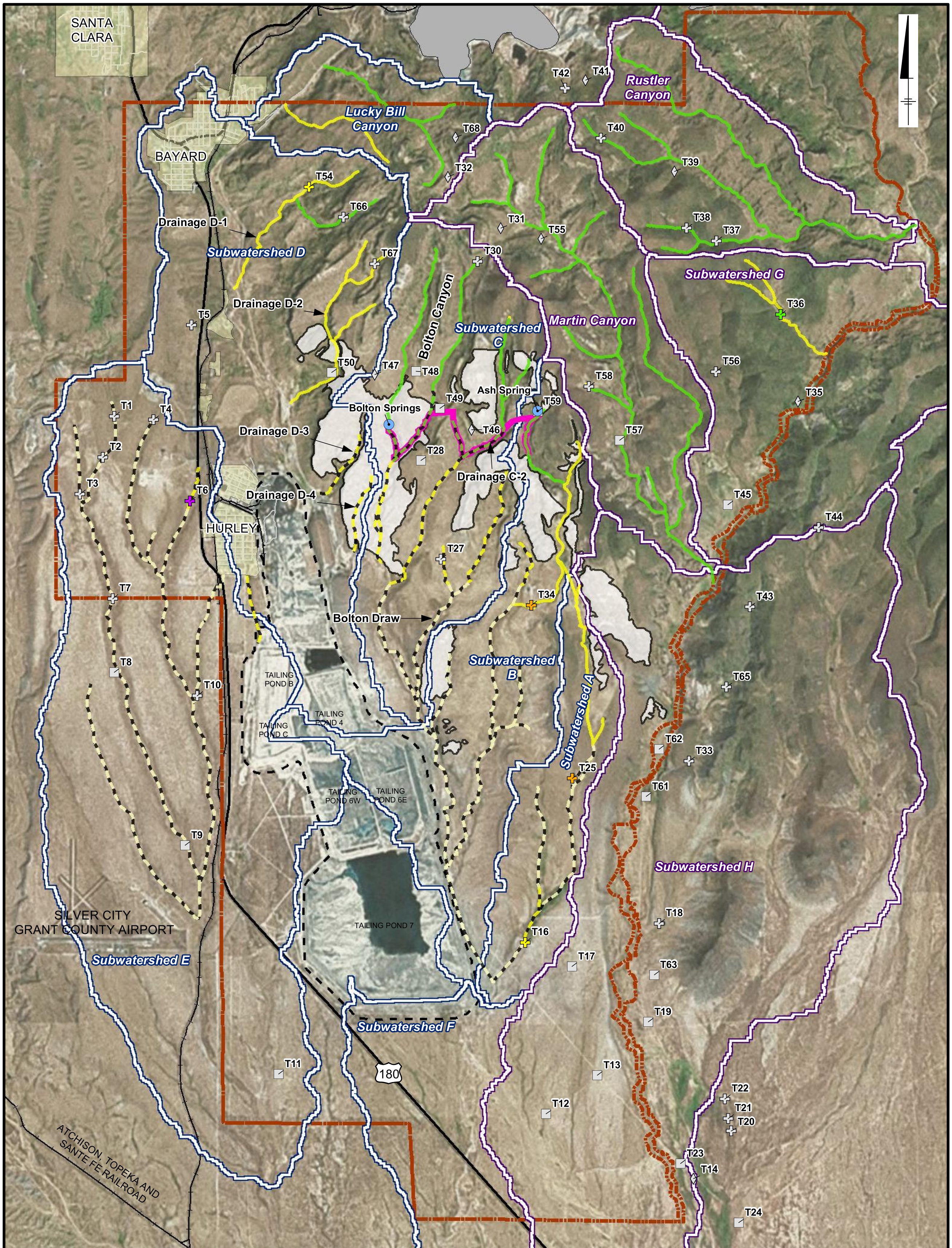
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILINGS SOILS IU FS

NATURE AND EXTENT OF COPPER CONTAMINATION TO SURFACE WATER DRAINAGES

ARCADIS

FIGURE 4-3

OFFICE: LAKEWOOD DB: MLM TM: MB PM: AT
PROJECT# B0063543.0000
T:_ENV\Chino\2022\MXD\FS\Fig_4-04_StockTanks_HQ.mxd



LEGEND:

- Springs
- USFWS Critical Habitat Transect
- STSIU Boundary
- Bedrock Extents
- Lampbright Subwatershed Boundaries
- Hanover-Whitewater Subwatershed Boundaries

Stream Type/Condition

- Non-Ephemeral/Confident No Concerns
- Non-Ephemeral/Potential Active Remediation or Monitored Natural Attenuation
- Ephemeral/Confident No Concerns Based on Proposed WER Model
- Ephemeral/Potential Active Remediation or Monitored Natural Attenuation
- Ephemeral/Limited Potential for Pools

- Earthen Impoundments in the Drainage
- Earthen Impoundments Outside the Drainage
- Concrete or Steel Tank

Highest HQ Value

- No Data
- <1
- 1 - 3
- 3 - 7
- >7

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

0 5,000 10,000 Feet
GRAPHIC SCALE

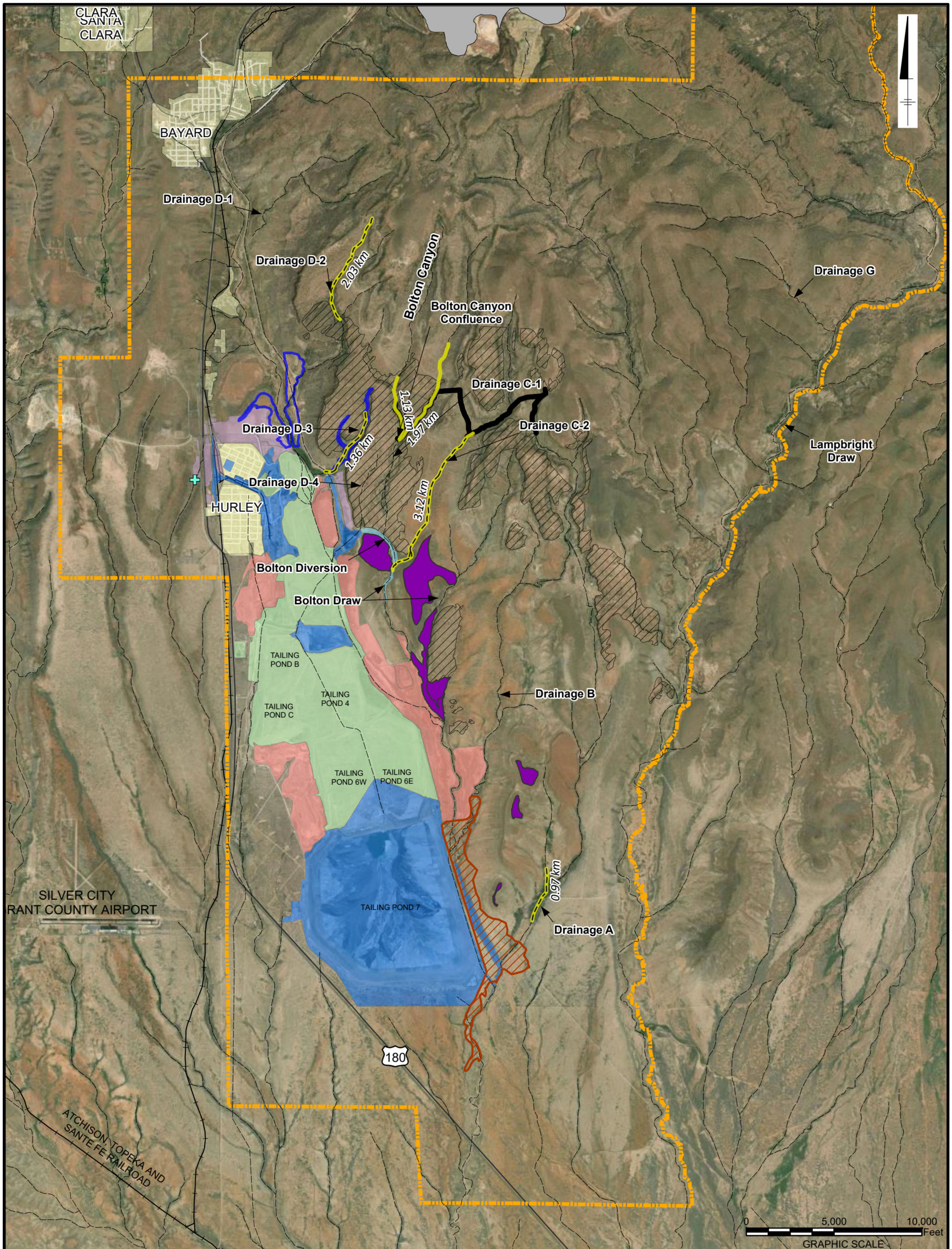
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILINGS SOILS IU FS

STSIU STOCK TANK LOCATIONS

ARCADIS

FIGURE
4-4

OFFICE: LAKEWOOD DB: MLM TM: MB PM: AT
PROJECT# B0063543.0000
T:_ENV\Chino\2024\FS\Pro\STSIU Figure Collection 4-8\STSIU Figure Collection 4-8\2024_STSIU_Figures.aprx



LEGEND:

Stock Tank Proposed for Monitoring

Stream Type/Condition

- Ephemeral/Proposed for Monitoring
- Non-Ephemeral/Proposed for Monitoring
- USFWS Critical Habitat Transect

pCu-driven Action

- Flat Rocky Soil < 4.98 pCu & Cu > 327
- Bedrock Extents
- Recent Windblown Tailings from TP-7 Outside Operational Boundary
- STSIU Boundary

- Avian Monitoring Boundary
- Stockpiles
- Local City
- Borrow Pit
- CCP
- Diversion Project
- Hurley Soils IU
- IRAs
- Operations

Notes:
1. Service Layer Credits: World Imagery: Earthstar Geographics.
2. While this figure portrays a scenario where PEL Criteria is 4.98, the final acres are based on a PEL of 4.6 (and 140 acres are posed for monitoring).
3. Southern edge of blue polygon includes recent windblown tailings from TP-7 inside the operational boundary (see Figure 3-2a).

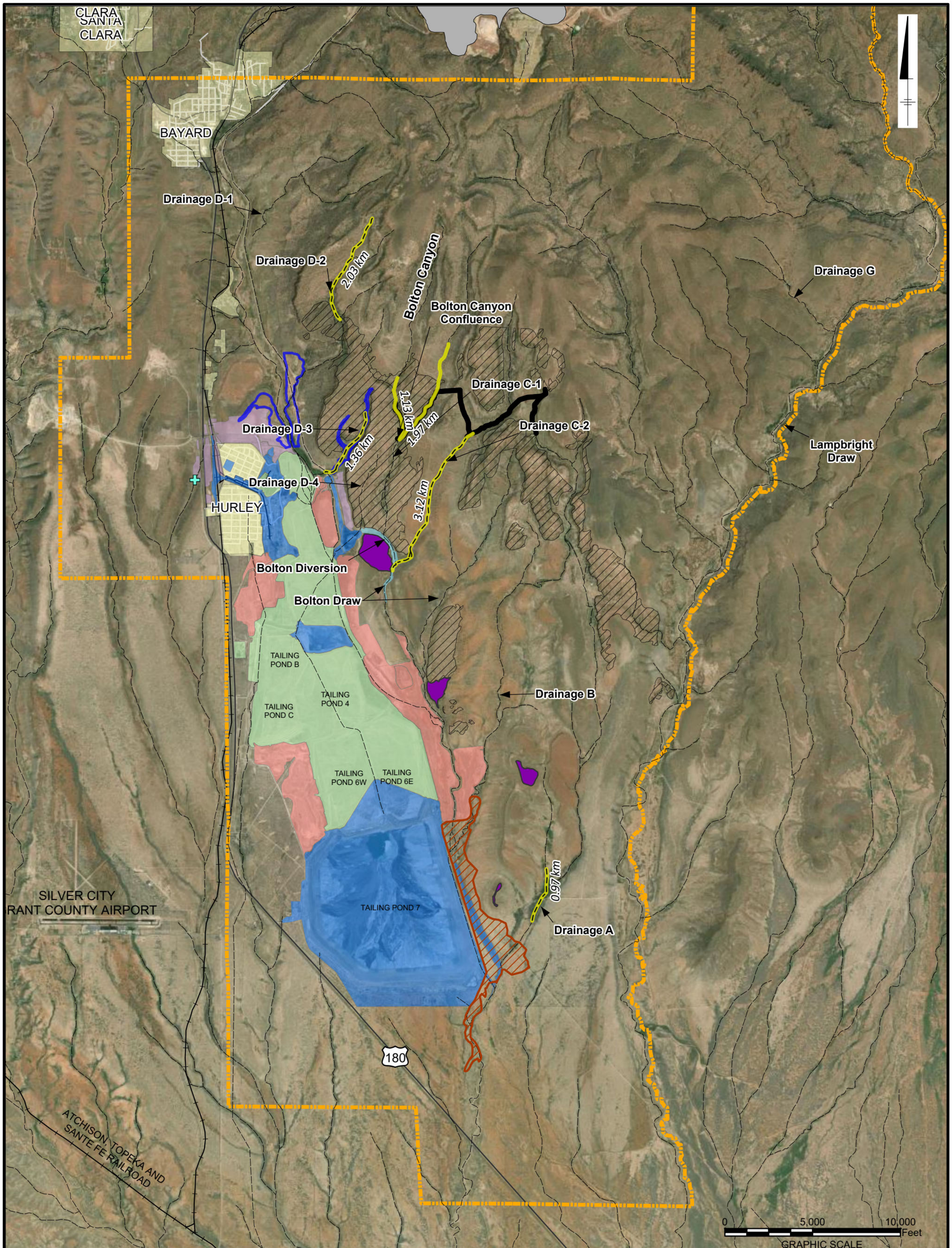
FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILINGS SOILS IU FS

AREAS IDENTIFIED FOR REMEDY OR MONITORING

ARCADIS

FIGURE 8-1

OFFICE: LAKEWOOD DB: MLM TM: MB PM: AT
PROJECT# B0063543.0000
T:_ENV\Chino\2024\FS\Pro\STSIU Figure Collection 4-8\STSIU Figure Collection 4-8\2024_STSIU_Figures.aprx



LEGEND:

Stock Tank Proposed for Monitoring

Stream Type/Condition

- Ephemeral/Proposed for Monitoring
- Non-Ephemeral/Proposed for Monitoring
- USFWS Critical Habitat Transect

pCu-driven Action

- Flat Rocky Soil < 4.6 pCu & Cu > 327
- Bedrock Extents
- Recent Windblown Tailings from TP-7 Outside Operational Boundary
- STSIU Boundary

- Avian Monitoring Boundary
- Stockpiles
- Local City
- Borrow Pit
- CCP
- Diversion Project
- Hurley Soils IU

- IRAs
- Operations

Notes:
1. Service Layer Credits: World Imagery: Earthstar Geographics.
2. Southern edge of blue polygon includes recent windblown tailings from TP-7 inside the operational boundary (see Figure 3-2a).

FREEPORT-MCMORAN CHINO MINES COMPANY
VANADIUM, NEW MEXICO
SMELTER/TAILINGS SOILS IU FS

PREFERRED AREAS IDENTIFIED FOR REMEDY OR MONITORING

ARCADIS

FIGURE 8-2